Design Standards Index 400 - Guardrail

New Index Sheets Overview

FDOT

FY 2016-17 Design Standards

Effective for Projects with Lettings in the Fiscal Year (FY) from

July 1, 2016 through June 30, 2017

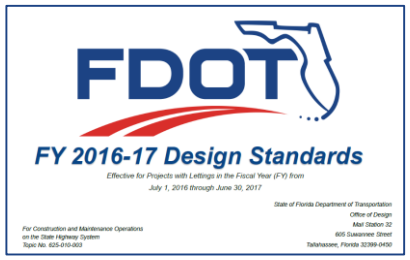
State of Florida Department of Transportation
Office of Design
Mail Station 32
605 Suwannee Street
Tallahassee, Florida 32399-0450

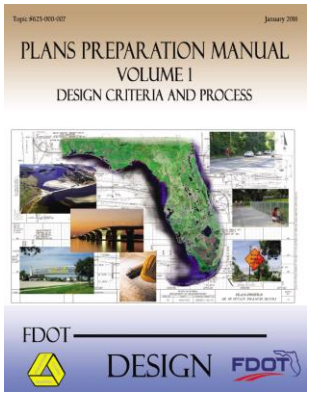
For Construction and Maintenance Operations
on the State Highway System
Topic No. 625-010-003

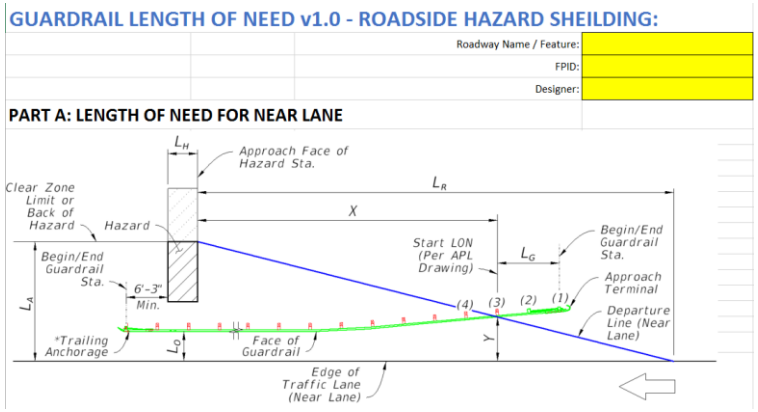
Index 400 is a DSR, as of February 1, 2016

Design Standards Index 400 - Guardrail

- **Index 400 – Guardrail**
  - **Complete Restructuring Project**
    - New Index Sheets (Redrawn)
    - New Specifications (currently MSPs)
    - New Instructions for Design Standards (IDS)
    - New Length of Need "Design Tool" (Excel Program)
    - Revised PPM Ch. 2 and 4 (Roadside Safety to Ch. 4)
    - Modifications of Existing Indexes for Compatibility (e.g. Index 402, 410, 411)







Design Standards Index 400 - Guardrail

Why change?...

Clarity. Updates. Effectiveness.

OLD INDEX:

- **34 sheets long**
- lengthy verbiage, 'passive voice'
- old scanned-in drawings
- includes information for the designer
- includes Spec. style language
- has previous **NCHRP350** Guardrail Transition to 'Bridge Railings'
- has only TL-3 guardrail options
- 'Length of Need' uses a simplified method based on previous criteria

NEW INDEX:

- **22 sheets long** (with Table of Contents)
- concise verbiage, 'active voice', note headings
- new drawings to scale, latest labeling practice
- designer information moved to PPM and IDS
- Spec. language moved to the Specifications
- has latest **MASH** tested Guardrail Transitions to 'Rigid Barrier' (Both Railings and Barriers)
- has both TL-3 & TL-2 guardrail options
- 'Length of Need' calculations cover more cases, based on AASHTO RDG criteria

Design Standards Index 400 - Guardrail

Where is it?...

Easiest to Google "FDOT Standards"

http://www.dot.state.fl.us/rddesign/DesignStandards/Standards.shtm

Office of Design

Office of Design / Design Standards

Design Standards

INDUSTRY REVIEW

Modification Request Origination Form

Industry Review

Status of Proposed Revisions

CURRENT PUBLICATION

Effective July 1, 2016 - June 30, 2017

Year	Design Standards eBook	Design Standards Revisions	Implementation Bulletin
FY 2016-17	DSeB	DSR	RDB15-15

Office of Design

Office of Design / Design Standards / Design Standards Revisions FY 2016-17

Design Standards Revisions FY 2016-17

n/a = Non Applicable

n/c = No Change

Index Number	Revised Sheets (PDF)	Index Title	Design Information: Instructions (IDS) (PDF)	Design Tools (Link)	Data Table Cell Library (ZIP)	Borderless DGNs (ZIP) Terms of Use	Associated Design Bulletin (PDF)
400	1-22 of 22	Guardrail	IDS-00400	XLS	N/A	DGN	RDB16-01
410	2,10, 16-18 of 25	Concrete Barrier Wall	N/A	N/A		DGN	
411	6 of 10	Pier Protection Barrier	N/C	N/A		DGN	

Design Standards Index 400 - Guardrail

Implementation Schedule…

Roadway Design Bulletin 16-01

The Index Sheets and Instructions for Design Standards discussed refer to the February 1st DSR to the 2016-17 Design Standards eBook. The Specifications referred to will soon be available as Modified Special Provisions (MSPs).

These documents are available for use at the option of the Districts for all FDOT projects let prior to July 1st, 2017.

On July 1st, 2017 this update will become mandatory for FDOT projects, as it will be released with the 2017-18 Design Standards eBook.

Design Standards Index 400, Sheet 1

Table of Contents and General Notes:

SHEET NO.	CONTENTS
1	General Notes; Index Contents
2	General, TL-3 Guardrail - Installed Plan and Elevation
3	Low-Speed, TL-2 Guardrail - Installed Plan and Elevation
4	W-Beam and Thrie-Beam Panel Details
5	Post and Offset Block Details
6	Guardrail Sections - Heights and Adjacent Slopes
7	End Treatment - Approach Terminal Geometry, Parallel and Flared
8	End Treatment - Approach Terminal Geometry, Curbed and Double Faced
9	End Treatment - Trailing Anchorage Type II
10	End Treatment - Component Details
11	End Treatment - Controlled Release Terminal (CRT) System
12	Layout for CRT System - Side Roads and Driveways
13	Approach Transition Connection to Rigid Barrier - General, TL-3
14	Approach Transition Connection to Rigid Barrier - Low-Speed, TL-2
15	Approach Transition Connection to Rigid Barrier - Details
16	Approach Transition Connection to Rigid Barrier - Double Faced Guardrail
17	Layout to Rigid Barrier - Approach Ends
18	Layout to Rigid Barrier - Approach Ends with Double Faced Guardrail Layout to Rigid Barrier - Trailing Ends
19	Rub Rail Details
20	Pedestrian Safety Treatment - Pipe Rail
21	Modified Mount - Special Steel Post for Concrete Structure Mount; Modified Mount - Encased Post for Shallow Mount; Modified Mount - Frangible Leave-Out for Concrete Surface Mount
22	Barrier Delineators - Post Mounted; Clear Space - Reduced Post Spacing for Hazards; ⅝" Button-Head Bolt System

GENERAL NOTES:

1. INSTALLATION: Construct guardrail in accordance with Specification Section 536.

   This Index, along with the plans and the manufacturers' drawings on the Approved Products List (APL), is sufficiently detailed for installation of General Guardrail, Low-Speed Guardrail, End Treatment assemblies, and their connecting options shown herein. This precludes requirements for shop drawing submittals unless otherwise specified in the plans.

2. COMPATIBILITY: The General Guardrail in this Index is based on the Midwest Guardrail System (MGS) design, with a 31" height at the top of the Panel (2'-1" mounting height at ℄ of Panel) and a midspan panel splice as shown on Sheet 2. Guardrail components included on the APL, which are compatible with this Index, may also be identified as 31" or MGS Guardrail.

3. STANDARD COMPONENTS: Standard guardrail components, including posts, panels, and bolt systems, are based upon English unit conversions of the AASHTO-AGC-ARTBA Joint Committee Task Force 13 Report: A Guide to Standardized Highway Barrier Hardware (http://www.aashtotf13.org/Barrier-Hardware.php).

4. BUTTON-HEAD BOLTS: Install Button-Head Bolts where indicated using bolts, nuts, and washers as defined on Sheet 22. Place washers under nuts; washers are optional against steel flanges. Do not place washers between bolt heads and panels, except where otherwise shown in this Index.

5. HEX-HEAD BOLTS: Install Hex-Head Bolts where indicated using bolts, nuts, and washers in accordance with material properties of Specification Section 967. Place washers under nuts; washers are optional against steel flanges.

6. MISCELLANEOUS ASPHALT PAVEMENT: Install Miscellaneous Asphalt Pavement where indicated in accordance with Specification Section 339.

7. ADJACENT SIDEWALKS & SHARED USE PATHS: When guardrail posts are placed within 4'-0" of a sidewalk or shared use path, use timber posts, or use steel posts only if treated with Pipe Rail as shown on Sheet 20.

   When timber posts are used, one of the following safety treatments is required for the bolt(s) protruding from the back face of the posts:

   a. After tightening the nut, trim the protruding post bolt flush with the nut and galvanize per Specification Section 562.
   b. Use post bolts 15" in length and countersink the washer and nut between 1" and 1½" deep into the back face of the post.
   c. Use 15" post bolts with sleeve nuts and washers.

   When End Treatment posts are within 4'-0" of a sidewalk or shared use path, steel posts are not permitted within the End Treatment segment. Terminate the Pipe Rail outside of End Treatment segments, as noted per Sheet 20.

8. CONNECTION TO EXISTING GUARDRAIL: Where a transition to existing guardrail at 27" height is required, linearly transition the guardrail height over a distance ranging from 25'-0" to 31"-3". Provide an immediate transition to the required midspan splice using the available panel options on Sheet 4.

9. PLAN CALLOUTS: Begin/End Station labels are shown throughout this Index as they correspond to the station and offset callouts specified in the plans.

   In the plans, Begin/End Guardrail Station refers to General TL-3 Guardrail, and it may be abbreviated as Begin/End GR. Sta. Where Low-Speed TL-2 Guardrail is specifically required, the callout in the plans will then specify Begin/End TL-2 GR. Sta.

10. QUANTITY MEASUREMENT: Measure guardrail and corresponding components as defined in Specification Section 536. The Guardrail length is measured along the centerline of installed Panels, between the points labeled Begin/End Guardrail Station shown on the following Index Sheets and defined in the plans (typically measured from the ℄ of the panel's post bolt slots at the approach/trailing ends).

LAST REVISION	REVISION	DESCRIPTION:			INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	400	1 of 22

- Added Table of Contents
- Re-ordered sheets in an intuitive sequence

Design Standards Index 400, Sheet 1

Table of Contents:

Design Standards Index 400, Sheet 1

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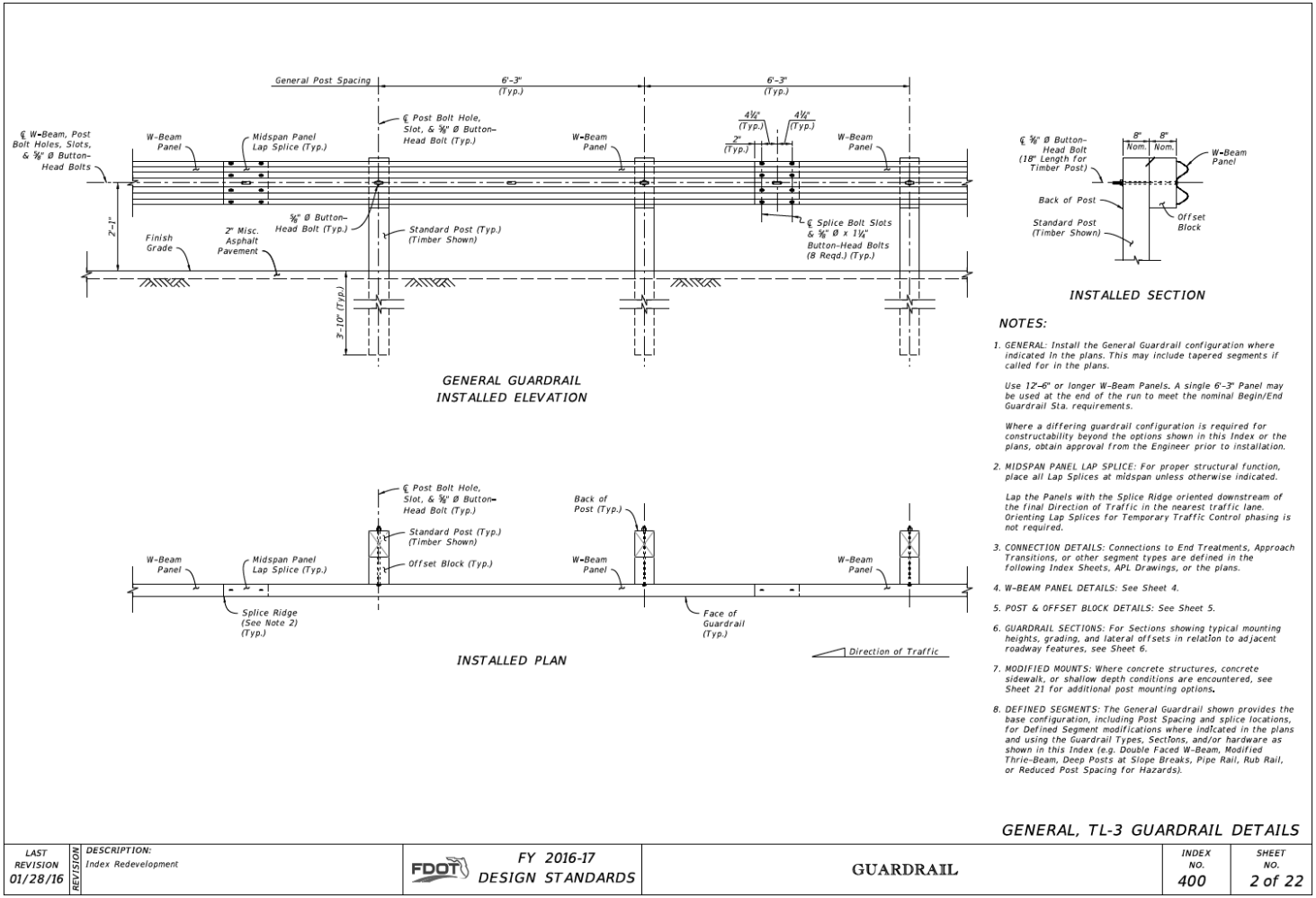
NOTES Highlights:

2. This is considered 31" height Guardrail (based on MGS design)
8. How to connect to existing guardrail (transition)
9. Plans Callouts
10. Guardrail Length Measurement

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:



NOTES:

1. GENERAL: Install the General Guardrail configuration where indicated in the plans. This may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels. A single 6'-3" Panel may be used at the end of the run to meet the nominal Begin/End Guardrail Sta. requirements.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

4. W-BEAM PANEL DETAILS: See Sheet 4.

5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The General Guardrail shown provides the base configuration, including Post Spacing and splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

GENERAL, TL-3 GUARDRAIL DETAILS

LAST REVISION 01/28/16	REVISION	DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 2 of 22

- Configuration for "General" run of W-beam guardrail
- Applicable for TL-3 Design Speed and below

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:


0.000 sec


0.150 sec


0.280 sec

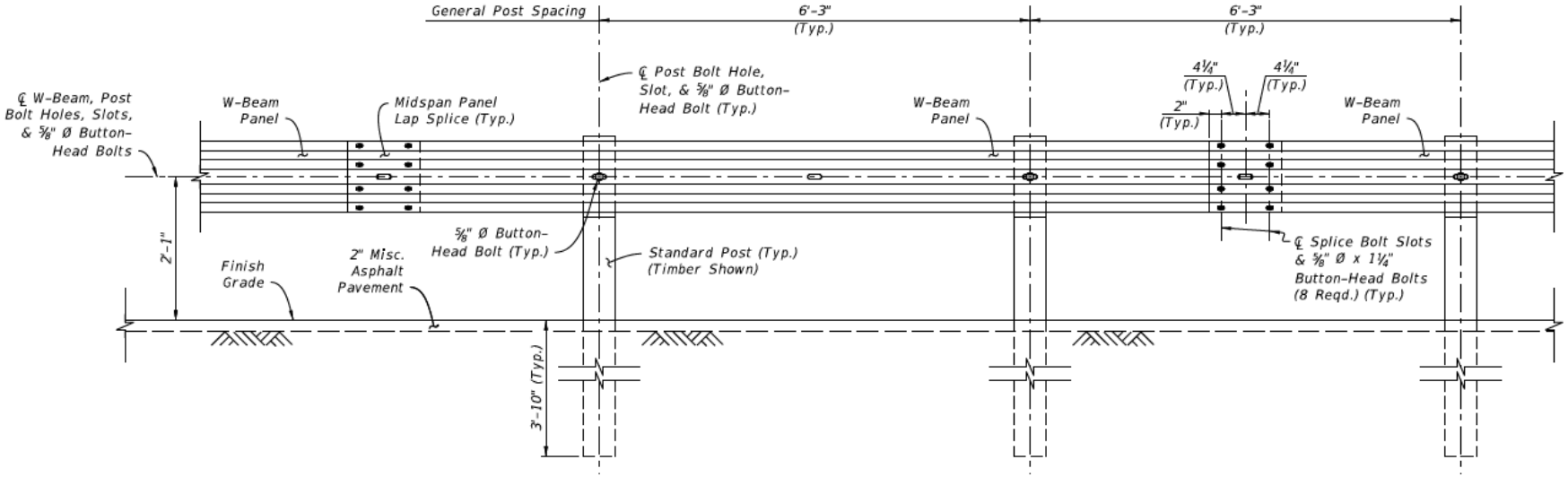

0.480 sec


0.948 sec

- Configuration for “General” run of W-beam guardrail
- Applicable for TL-3 Design Speed and below

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:



GENERAL GUARDRAIL
INSTALLED ELEVATION

General, TL-3 Guardrail is the same as the Previous Standard:

- **31” Height**
- 6’-3” Post Spacing
- Midspan Panel Splice
- 2” Miscellaneous Asphalt Pavt. (Mow Strip)
- 1 Offset Block Per Post

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:

NOTES:

1. GENERAL: Install the General Guardrail configuration where indicated in the plans. This may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels. A single 6'-3" Panel may be used at the end of the run to meet the nominal Begin/End Guardrail Sta. requirements.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

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7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

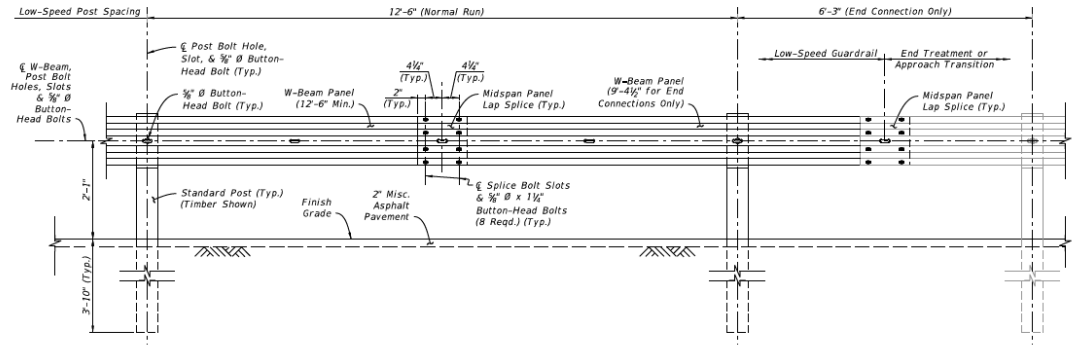
8. DEFINED SEGMENTS: The General Guardrail shown provides the base configuration, including Post Spacing and splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

NOTES Highlight:

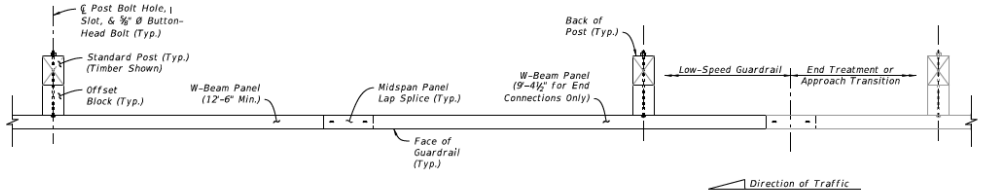
1. Contractors must use 12’-6” or 25’-0” Panels, but they may use a 6’-3” Panel at the end of the run. **Designers should design the nearest 6’-3” Panel length, measured along CL of panels*

Design Standards Index 400, Sheet 3

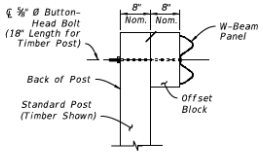
Low-Speed, TL-2 Guardrail Details:



LOW-SPEED GUARDRAIL INSTALLED ELEVATION



INSTALLED PLAN



INSTALLED SECTION

NOTES:

1. GENERAL: Install the Low-Speed Guardrail configuration where indicated in the plans. Low-Speed Guardrail may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels for normal spans, and use 9'-4½" Panels for end connections to adjoining segments as shown. A single 6'-3" Panel may be used at the end of the Low-Speed Guardrail run along with a single reduced 6'-3" post spacing to meet the nominal Begin/End Guardrail Sta. required.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the Plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

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6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The Low-Speed Guardrail shown provides the base configuration, including Post Spacing and Splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

LOW-SPEED, TL-2 GUARDRAIL DETAILS

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 3 of 22

- ***All New!***
- Double the post spacing
- Half the posts for cost savings (where applicable)
- Permitted for design speeds 45 MPH and Less (TL-2)
- Use only for flush shoulder conditions (no raised curbs)

Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:

- ***All New!***
- Double the post spacing
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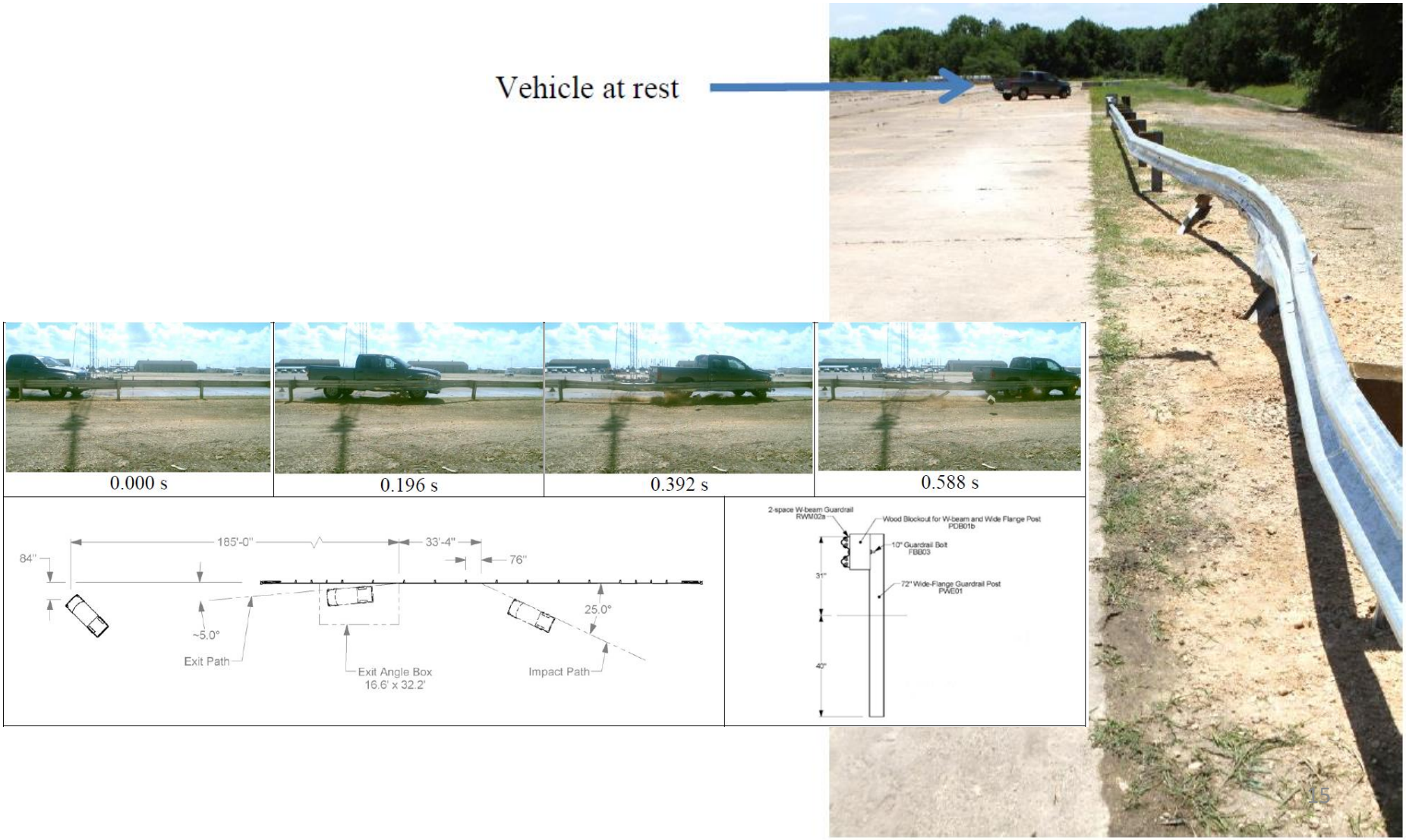
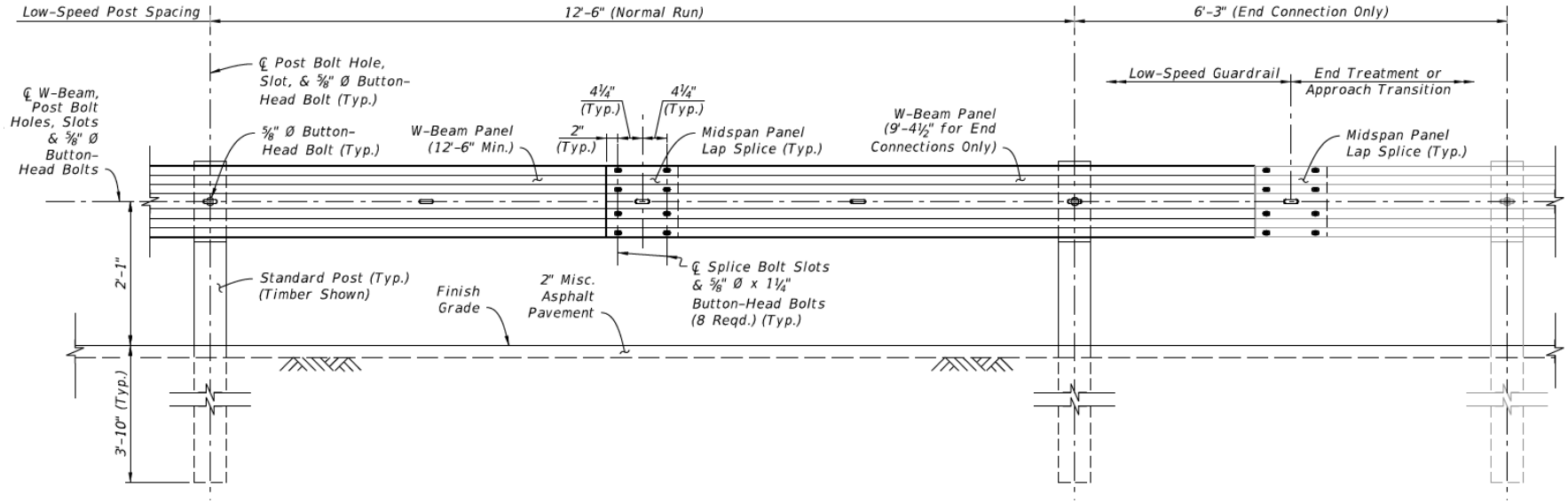
Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:



Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:



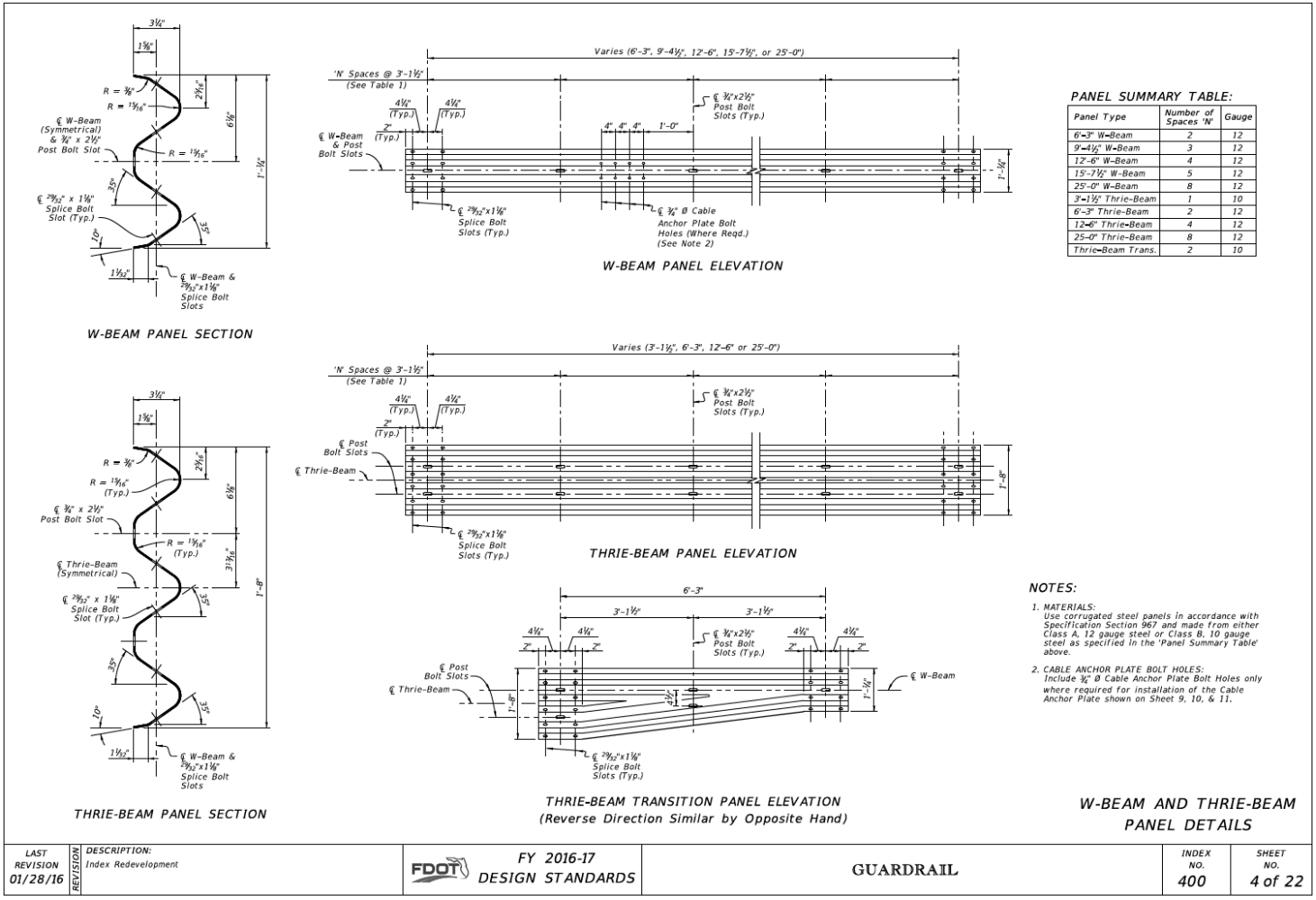
LOW-SPEED GUARDRAIL
INSTALLED ELEVATION

Low-Speed, TL-2 Guardrail is the same as *General Guardrail*, ***except***:

- **12'-6" Post Spacing**
- **Run ends with a 9'-4½ " Panel** to transition to other segment types (with 6'-3" span and midspan splice)

Design Standards Index 400, Sheet 4

W-Beam and Thrie-Beam Panel Details:



- Panel Options Shown on single Sheet
- Panels are used in General and Low-Speed Guardrail, Approach Transitions, End Treatments Etc…

Design Standards Index 400, Sheet 4

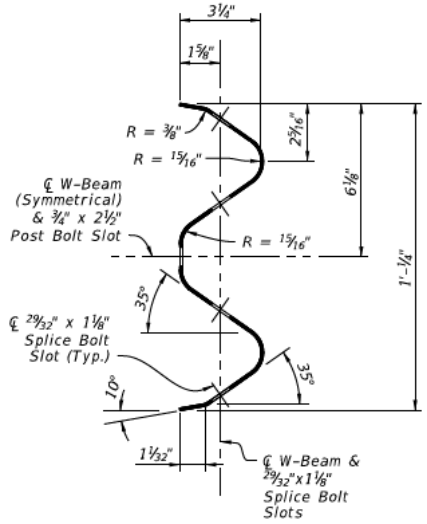
W-Beam and Thrie-Beam Panel Details:

Traditional Panel Jargon:

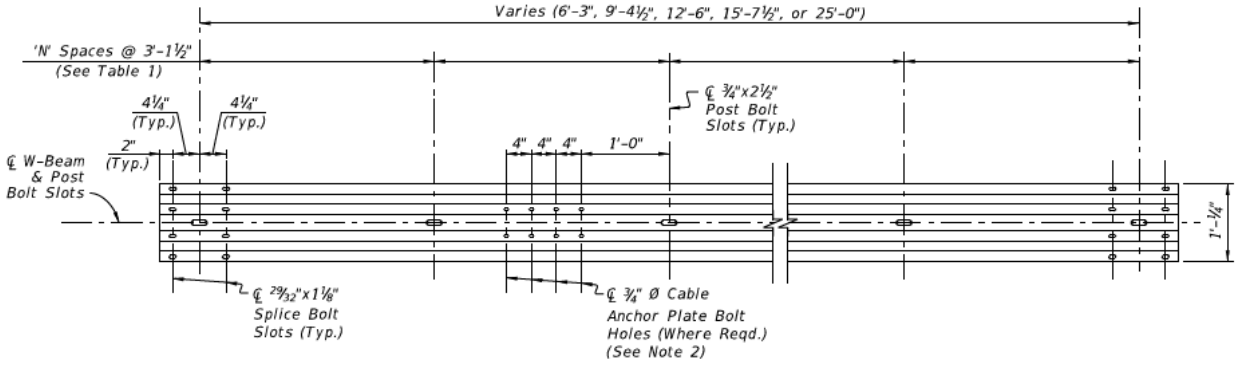
- Double Panel = 25’-0”
- Full Panel = 12’-6”
- Quarter Panel = 3’-1½”

Design Standards Index 400, Sheet 4

W-Beam and Thrie-Beam Panel Details:



W-BEAM PANEL SECTION



W-BEAM PANEL ELEVATION

More Flexibility Provided for Contractors:

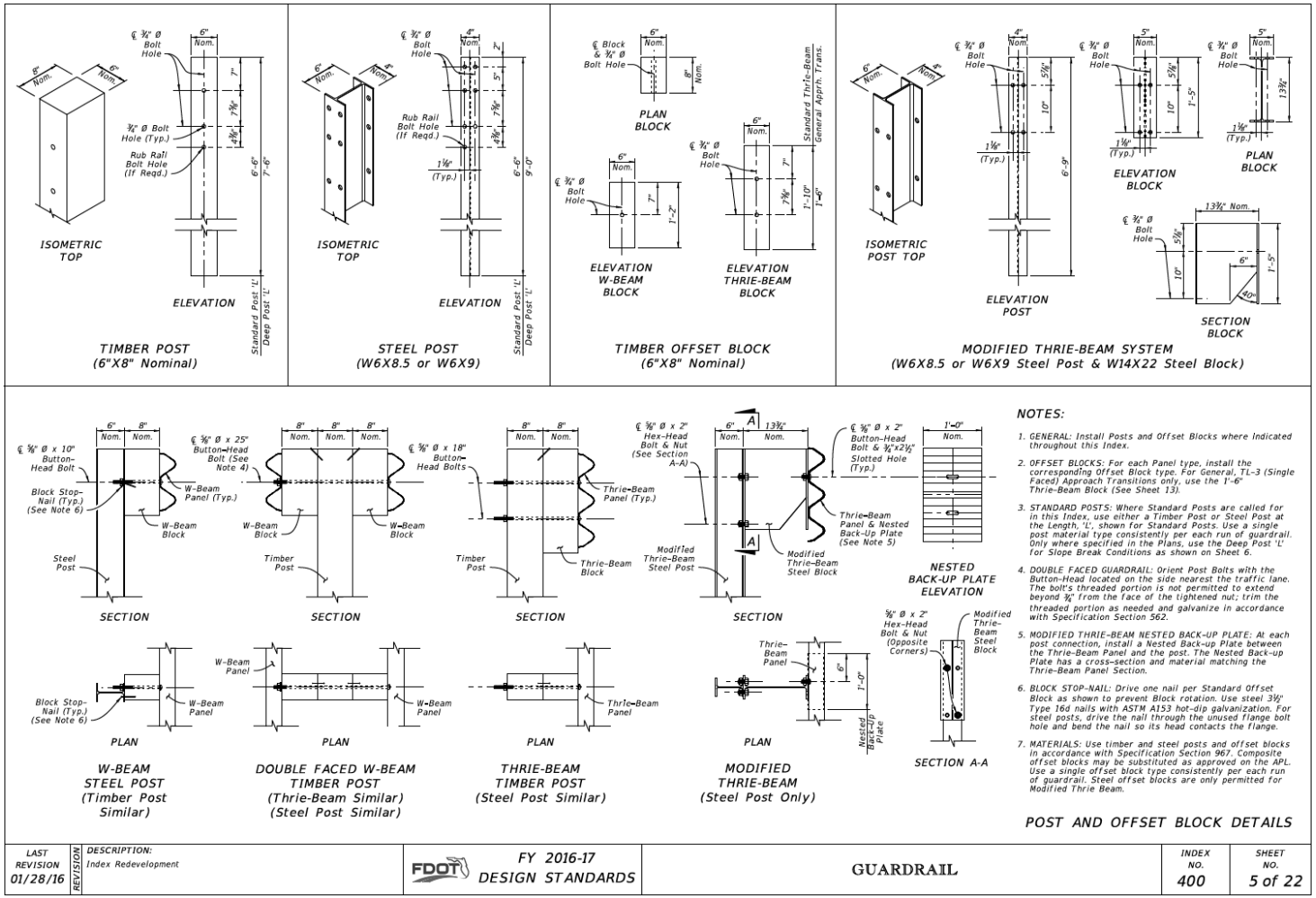
- ***6'-3" Panel*** *may be used at end of run to meet new guardrail length tolerance of ± 3'-1½" (Spec. 536) Generally acceptable for long runs with no conflicts (CEI may override tolerance for constrained conditions)*
- ***9'-4½" or 15'-7½" Panels*** *may be used to transition to midspan panel lap splices (for connecting to existing older guardrail with splices at post location)*
- ***25'-0" Panels*** *may now be used to reduce the number of splice bolt installations required by half*

PANEL SUMMARY TABLE:

Panel Type	Number of Spaces 'N'	Gauge
6'-3" W-Beam	2	12
9'-4½" W-Beam	3	12
12'-6" W-Beam	4	12
15'-7½" W-Beam	5	12
25'-0" W-Beam	8	12
3'-1½" Thrie-Beam	1	10
6'-3" Thrie-Beam	2	12
12-6" Thrie-Beam	4	12
25-0" Thrie-Beam	8	12
Thrie-Beam Trans.	2	10

Design Standards Index 400, Sheet 5

Post and Offset Block Details:



- Covers all Options for Post and Offset Block Configurations

Design Standards Index 400, Sheet 5

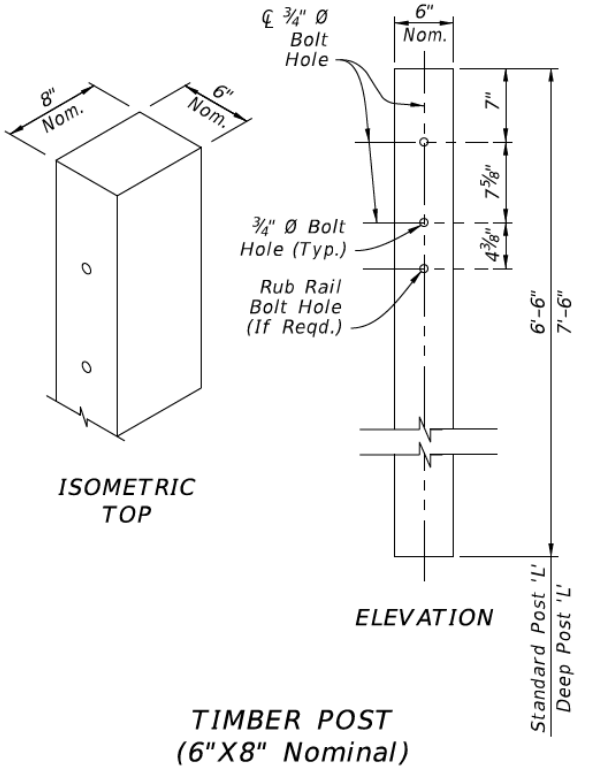
Post and Offset Block Details:

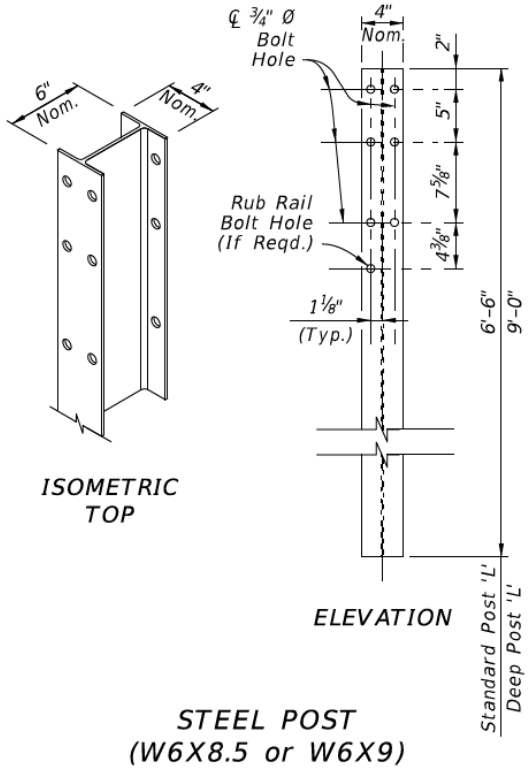
Offset Block Dimension is 6” x 8” Nominal (5.5” x 7.5” Actual)

7.5” is the offset dimension

Design Standards Index 400, Sheet 5

Post Details:

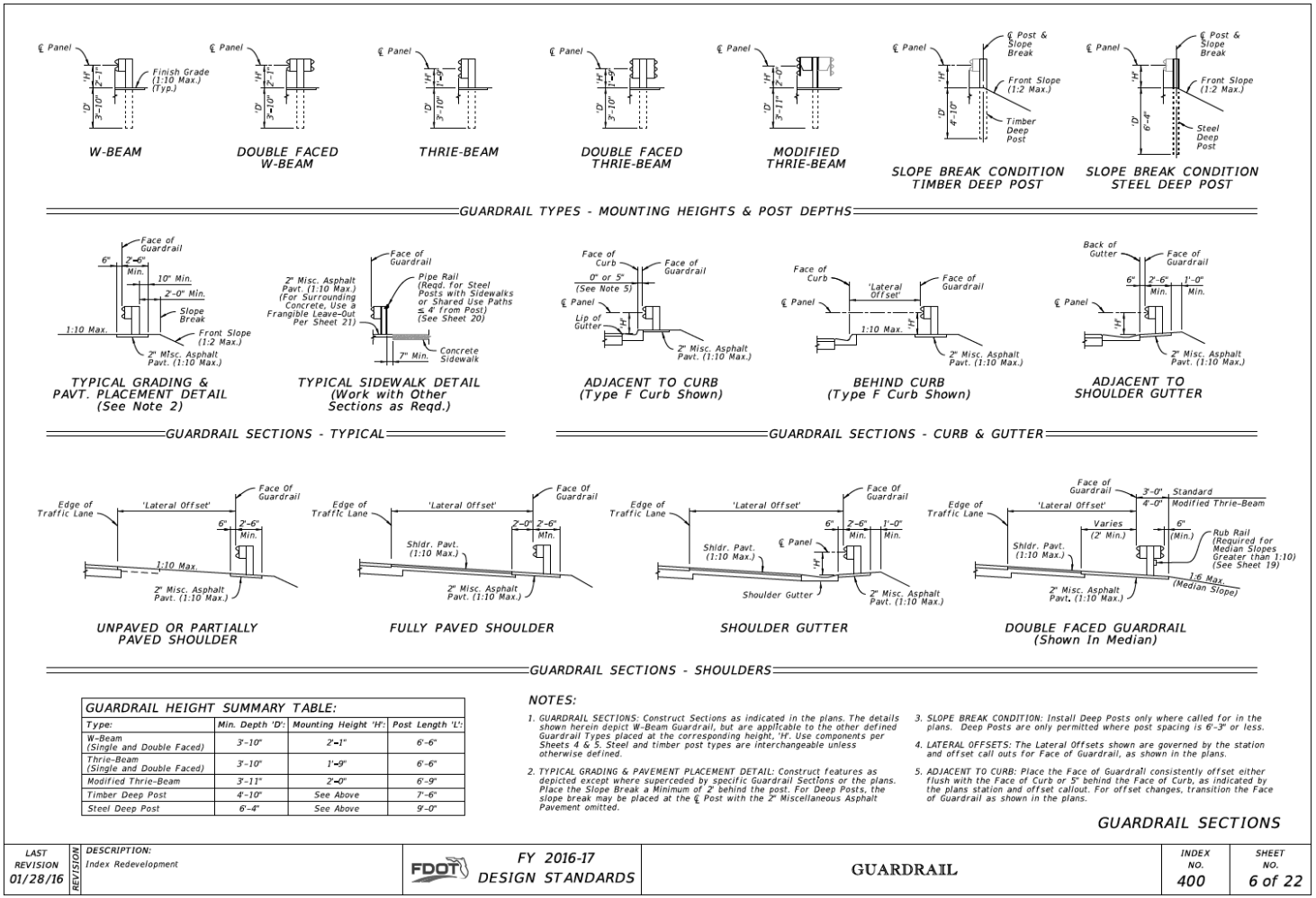




- **2 Post Lengths** (Depths)
  - *Standard 'L'*
  - *Deep Post 'L'*

Design Standards Index 400, Sheet 6

Guardrail Sections:



Summary:

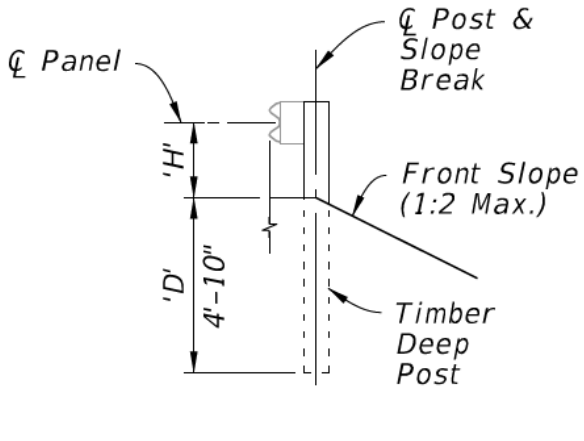
- Guardrail Heights & Depths
- Adjacent Grading (a.k.a. Slopes)
- 2” Misc. Asphalt Mow Strip
- Concrete Sidewalk
- Curb Conditions
- Shoulder Gutter
- Rub Rail

Design Standards Index 400, Sheet 6

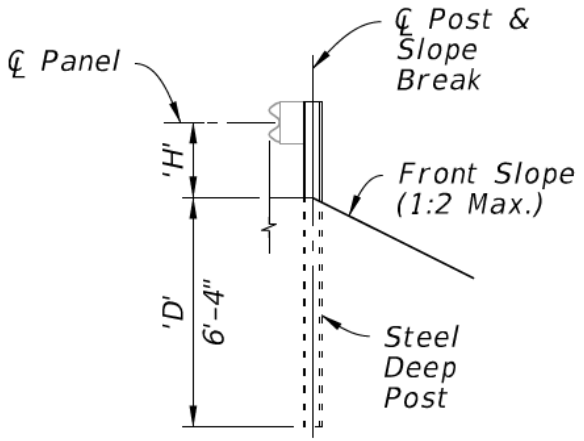
Guardrail Sections:

Slope Break Condition, "Deep Posts" *NEW!*

- **Contractor may only use Deep Posts where called for in the Plans.**



SLOPE BREAK CONDITION
TIMBER DEEP POST



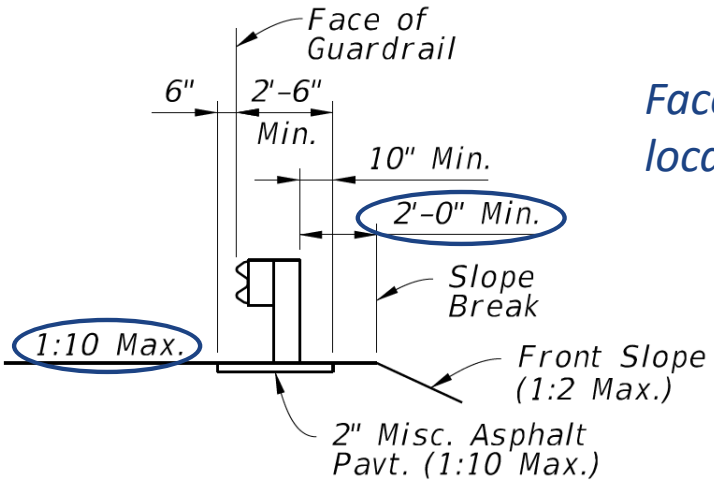
SLOPE BREAK CONDITION
STEEL DEEP POST

PPM 4.4.6.2 "With approval of the District Design Engineer and where right-of-way is restricted (i.e. constrained condition), the Deep Post guardrail option, as detailed in Design Standards, Index 400 Slope Break Condition, may be used in lieu of providing a 2 ft. setback to the slope break point. Coordinate the use of the Deep Post guardrail option with the District Drainage Engineer and District Maintenance Engineer."

Design Standards Index 400, Sheet 6

Guardrail Sections:

Typical Grading and Pavement Placement Detail



TYPICAL GRADING & PAVT. PLACEMENT DETAIL (See Note 2)

Face of Guardrail is always the location callout in Plans

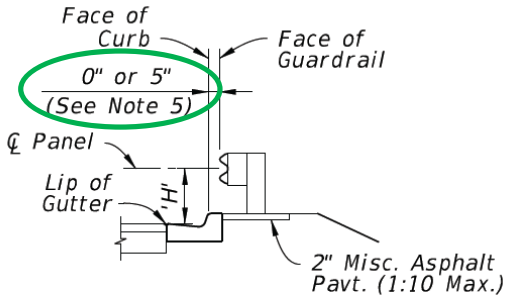
This Provides basic dimensions that may then be superseded by specific differences of other Standard Guardrail Sections.

(e.g. curbed or shoulder gutter sections)

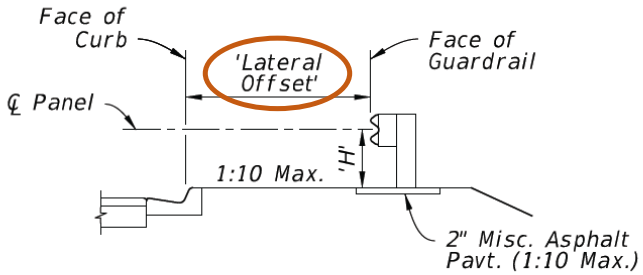
Design Standards Index 400, Sheet 6

Guardrail Sections:

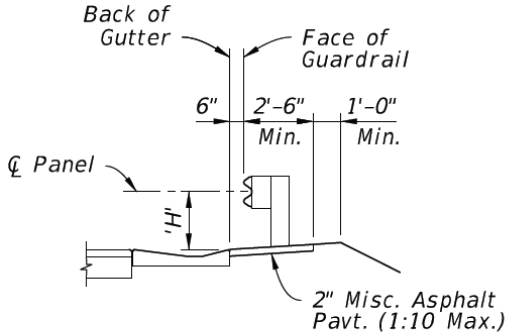
Curb and Gutter Sections



ADJACENT TO CURB
(Type F Curb Shown)



BEHIND CURB
(Type F Curb Shown)



ADJACENT TO SHOULDER GUTTER

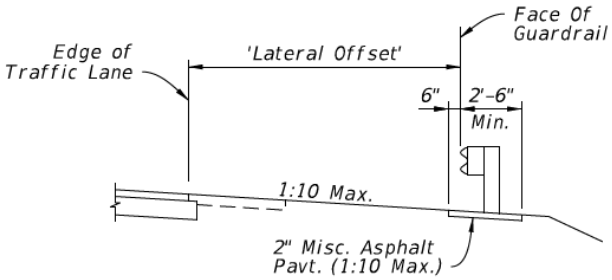
GUARDRAIL SECTIONS - CURB & GUTTER

- ***NEW!*** Guardrail placed 'Adjacent to Curb' may now be placed at either *0" or 5"* from Face of curb, defined per the Plans.
  (5" preferred to avoid nuisance hits, such as rearview mirrors)
- Lateral Offsets are defined per the Plans.
  *See PPM Section 2.3 "Shoulders" & Figure 4.4.12 "Offset to Guardrail"

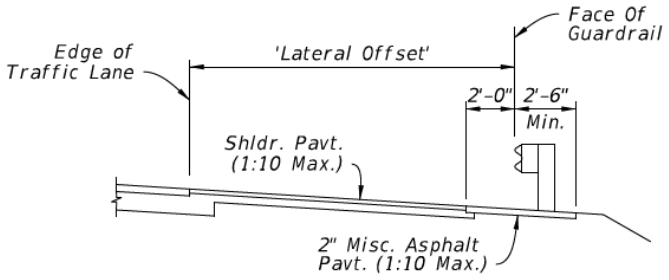
Design Standards Index 400, Sheet 6

Guardrail Sections:

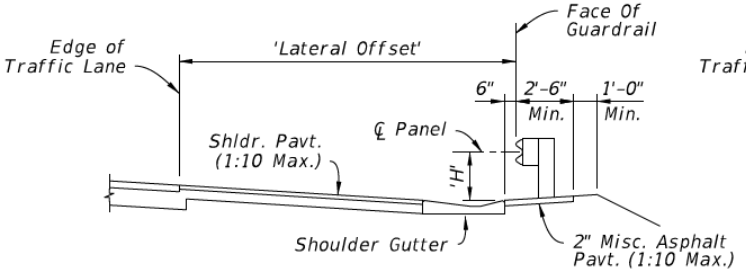
With Flush Shoulder



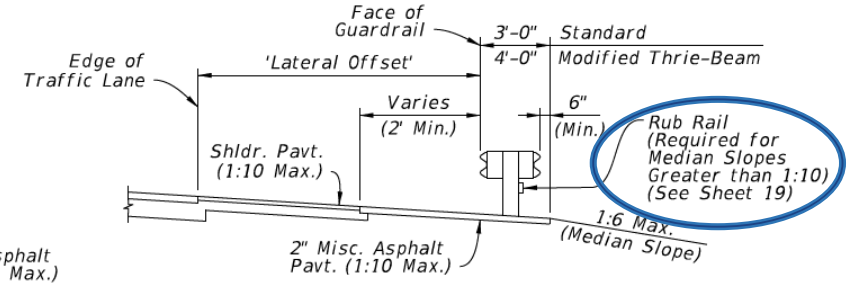
UNPAVED OR PARTIALLY PAVED SHOULDER



FULLY PAVED SHOULDER



SHOULDER GUTTER



DOUBLE FACED GUARDRAIL (Shown In Median)

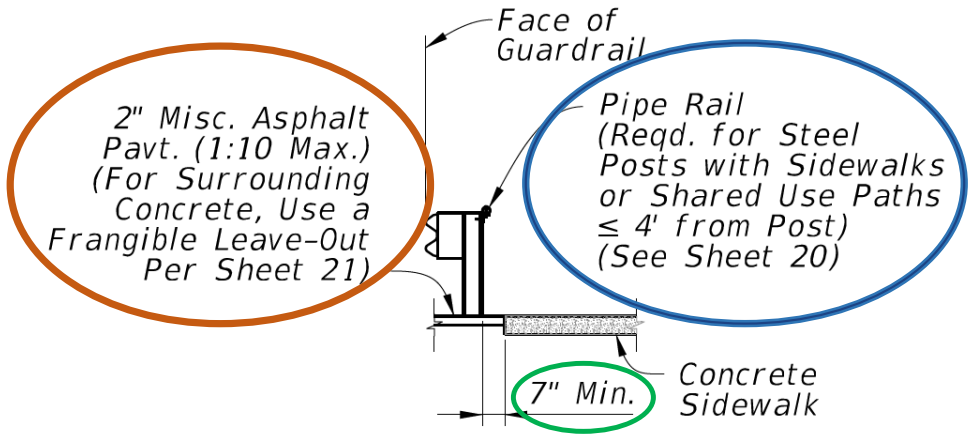
- Rub Rail is now only permitted for median side, slopes between 1:6 & 1:10

Design Standards Index 400, Sheet 6

Guardrail Sections:

Concrete is not permitted around base of post. A low strength "frangible" material must be used (either misc. asphalt of flowable fill)

Concrete Sidewalk *NEW!*



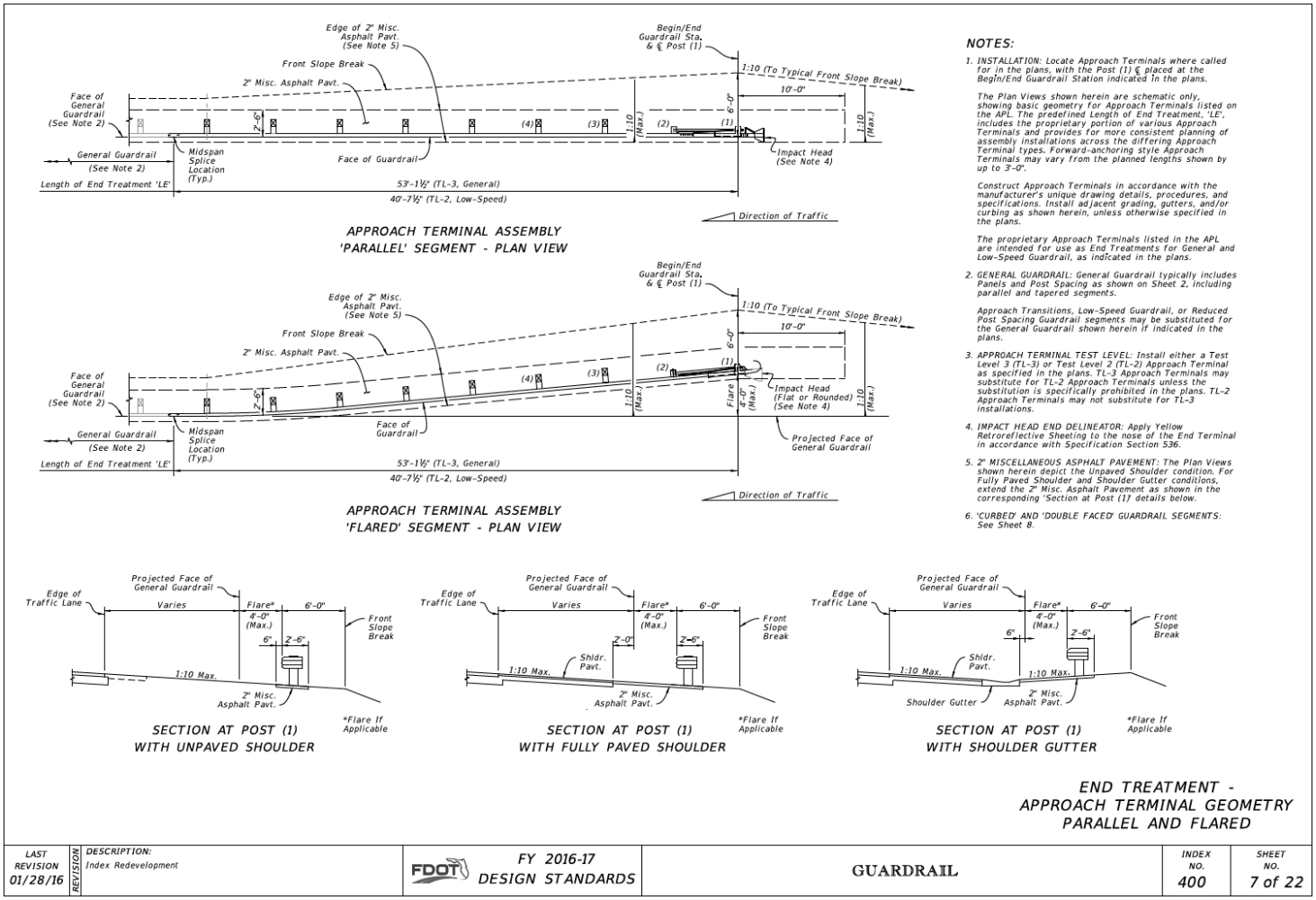
TYPICAL SIDEWALK DETAIL (Work with Other Sections as Reqd.)

- 7" Clearance is required from the back of post to the rigid concrete to facilitate proper rotation of posts upon vehicle impact
- If 2" Misc. Concrete Can't be placed at post location due to surrounding concrete, use the **"Frangible Leave-Out"** (defined later in the Index)
- When the back of steel posts will be within 4' of a Sidewalk or Shared Use Path, Pipe Rail must be used for pedestrian safety.

  NOTE: requires defining Begin/End Stations and length in the Plans

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Parallel and Flared:



- Shows basic geometry and grading requirements for APL *Approach Terminals*
- Provides pre-defined Lengths 'LE' that will accommodate all APL Terminals (for simpler Plans design)

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Parallel and Flared:

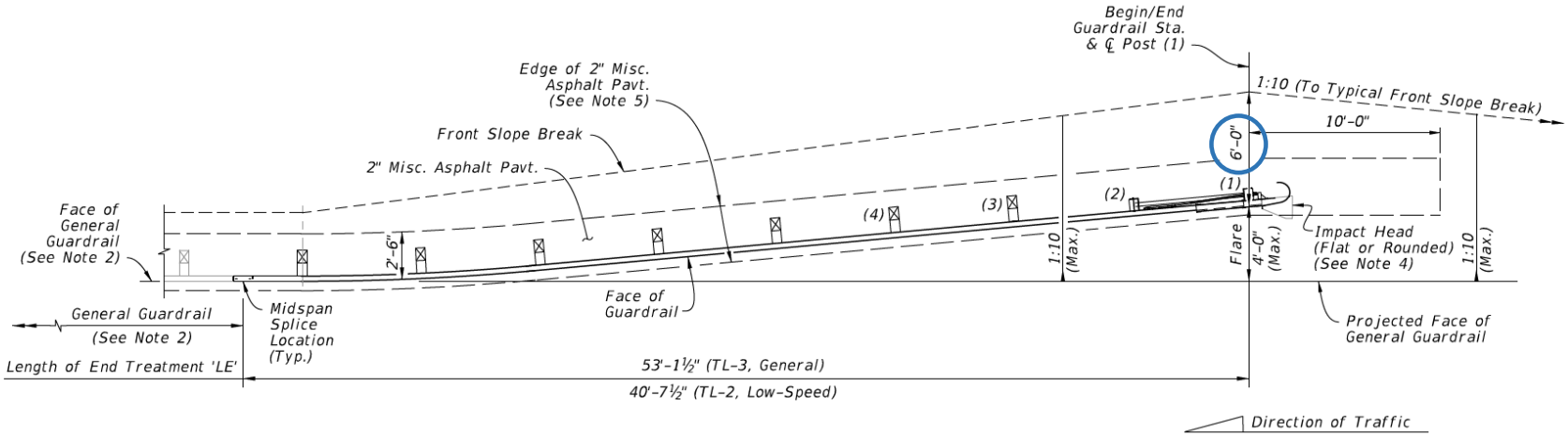
"Soft Stop"

"SKT"

- Shows basic geometry and grading requirements for APL *Approach Terminals*
- Provides pre-defined Lengths 'LE' that will accommodate all APL Terminals (for simpler Plans design)

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Flared:

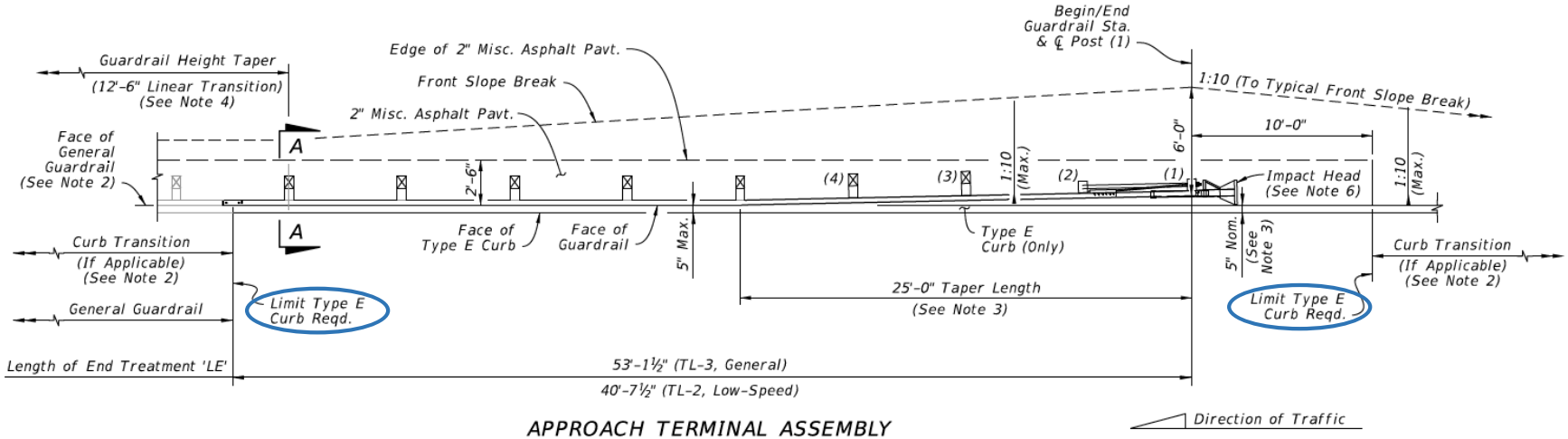


APPROACH TERMINAL ASSEMBLY
'FLARED' SEGMENT - PLAN VIEW

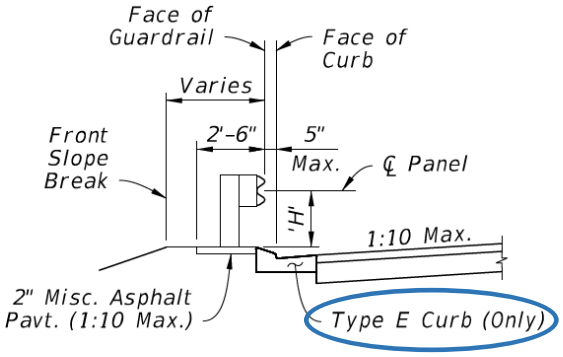
- Offset to Slope Break has changed to 6’-0” from face of guardrail (previous Standard showed 3’-0” from back of assembly)

Design Standards Index 400, Sheet 8

Approach Terminal Geometry, Curbed:



APPROACH TERMINAL ASSEMBLY
'CURBED' SEGMENT - PLAN VIEW

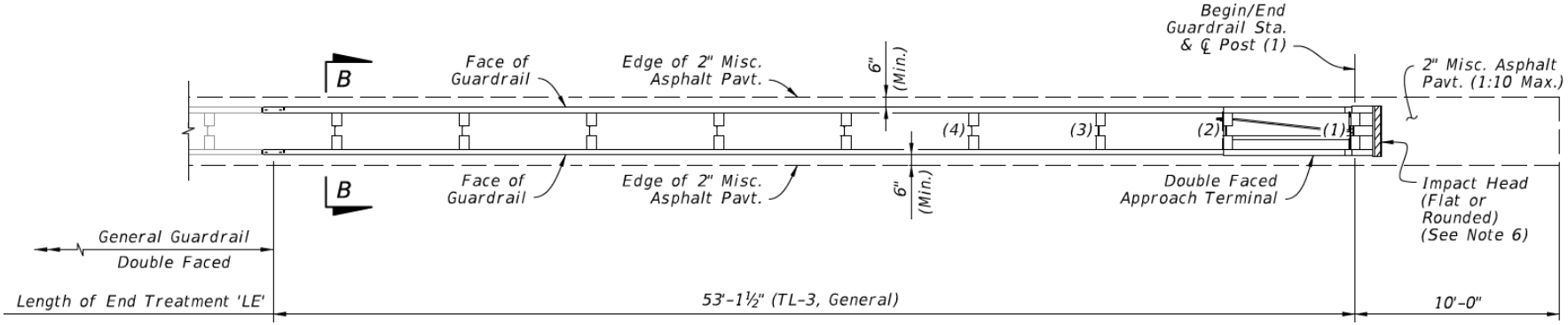


'CURBED' SECTION A-A
(Height, 'H', Measured from Misc. Asphalt Pavt.)

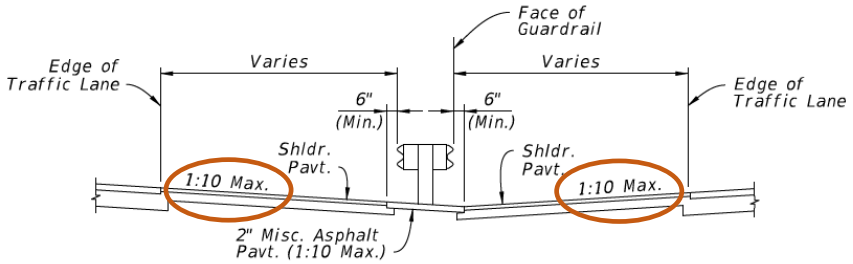
- **Type 'E' Curb** Required where shown

Design Standards Index 400, Sheet 8

Approach Terminal Geometry, Double Faced:



APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW

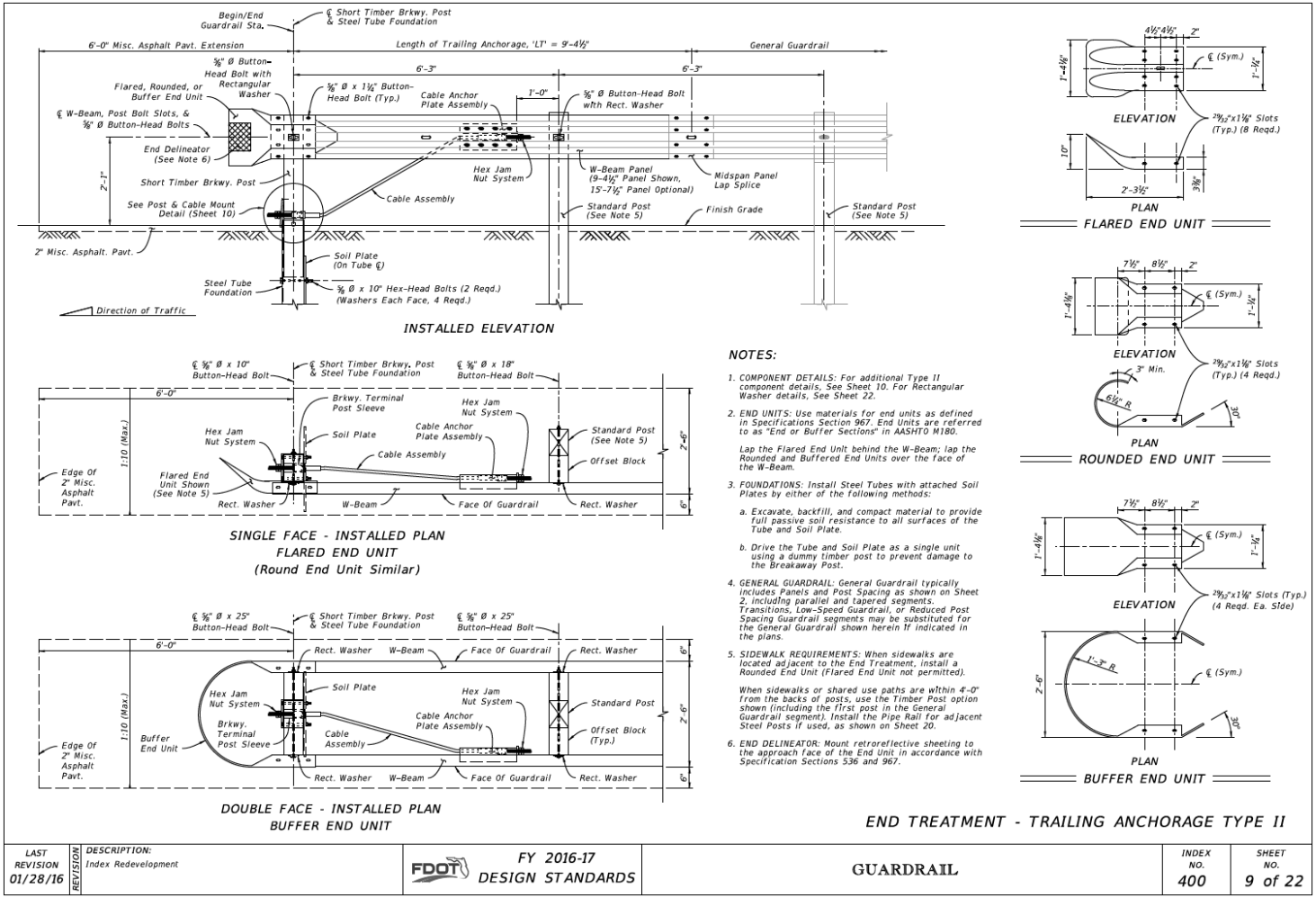


'DOUBLE FACED' SECTION B-B
(1:10 Slope or Flatter Reqd.)

- **'Double Faced'** option has always been available on the APL, but now it's shown in the Standard for better awareness.
  - Crash tested
  - Initial installation cost savings versus crash cushion
- **1:10 Max. cross slope** extends to Approach Terminal on *both sides.*
  - *Drainage structures may be required to convey median water*
  - *Outside of 'LE', transition longitudinally to typical median cross slope at 1:10 Max (in direction parallel to roadway).*

Design Standards Index 400, Sheet 9

Trailing Anchorage - Type II:



NOTES:

1. COMPONENT DETAILS: For additional Type II component details, See Sheet 10. For Rectangular Washer details, See Sheet 22.
2. END UNITS: Use materials for end units as defined in Specifications Section 967. End Units are referred to as "End or Buffer Sections" in AASHTO M180.

   Lap the Flared End Unit behind the W-Beam; lap the Rounded and Buffered End Units over the face of the W-Beam.
3. FOUNDATIONS: Install Steel Tubes with attached Soil Plates by either of the following methods:

   a. Excavate, backfill, and compact material to provide full passive soil resistance to all surfaces of the Tube and Soil Plate.

   b. Drive the Tube and Soil Plate as a single unit using a dummy timber post to prevent damage to the Breakaway Post.
4. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments. Transitions, Low-Speed Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.
5. SIDEWALK REQUIREMENTS: When sidewalks are located adjacent to the End Treatment, install a Rounded End Unit (Flared End Unit not permitted).

   When sidewalks or shared use paths are within 4'-0" from the backs of posts, use the Timber Post option shown (including the first post in the General Guardrail segment). Install the Pipe Rail for adjacent Steel Posts if used, as shown on Sheet 20.
6. END DELINEATOR: Mount retroreflective sheeting to the approach face of the End Unit in accordance with Specification Sections 536 and 967.

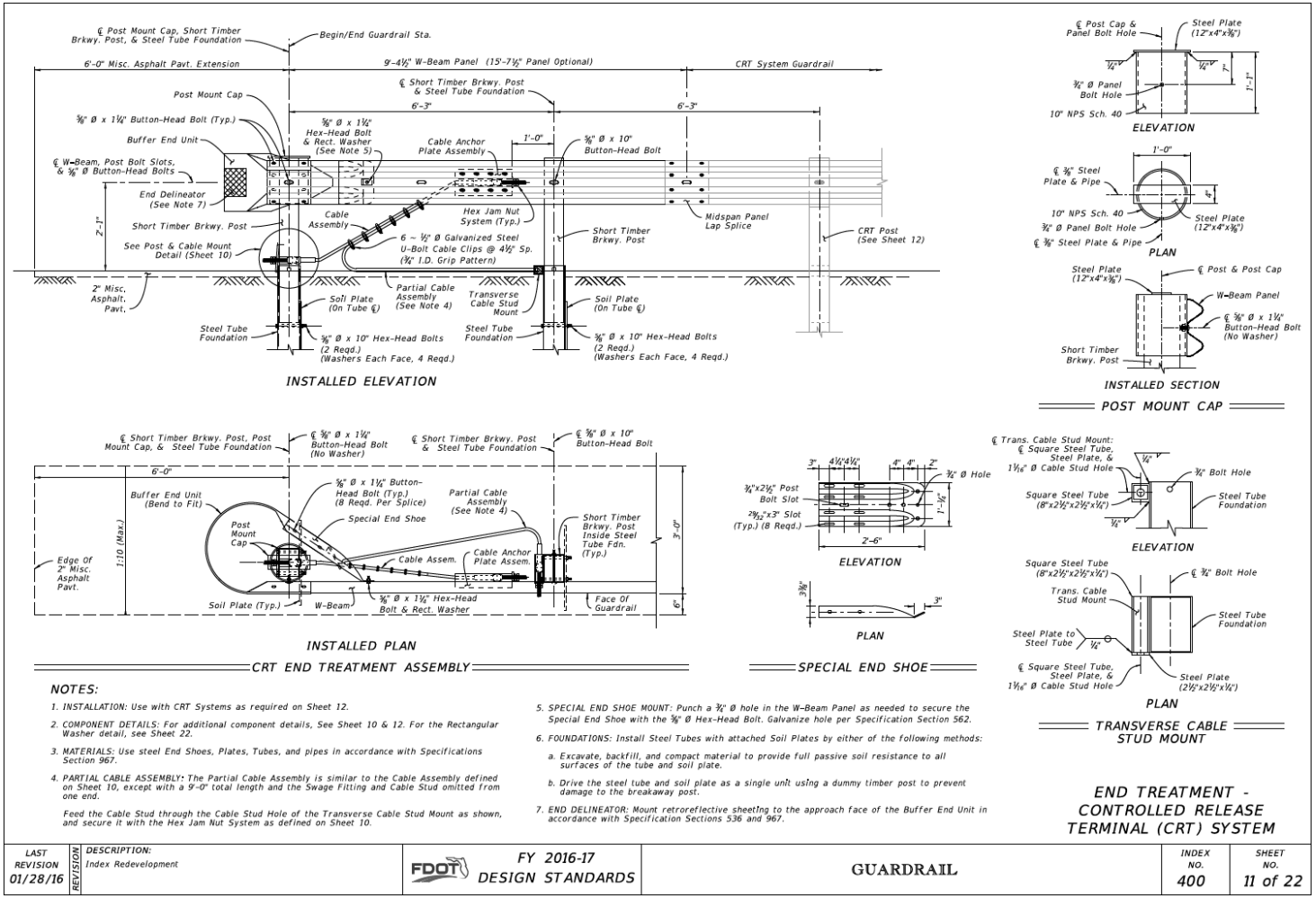
END TREATMENT - TRAILING ANCHORAGE TYPE II

LAST REVISION	REVISION	DESCRIPTION:	FDOT		INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FY 2016-17 DESIGN STANDARDS	GUARDRAIL	400	9 of 22

- Apply to "*Trailing*" guardrail ends to "*Anchor*" the guardrail. (Not "head-on" crashworthy like Approach Terminals are)
- Nearly same as previous Standard, just drafted more clearly

Design Standards Index 400, Sheet 11

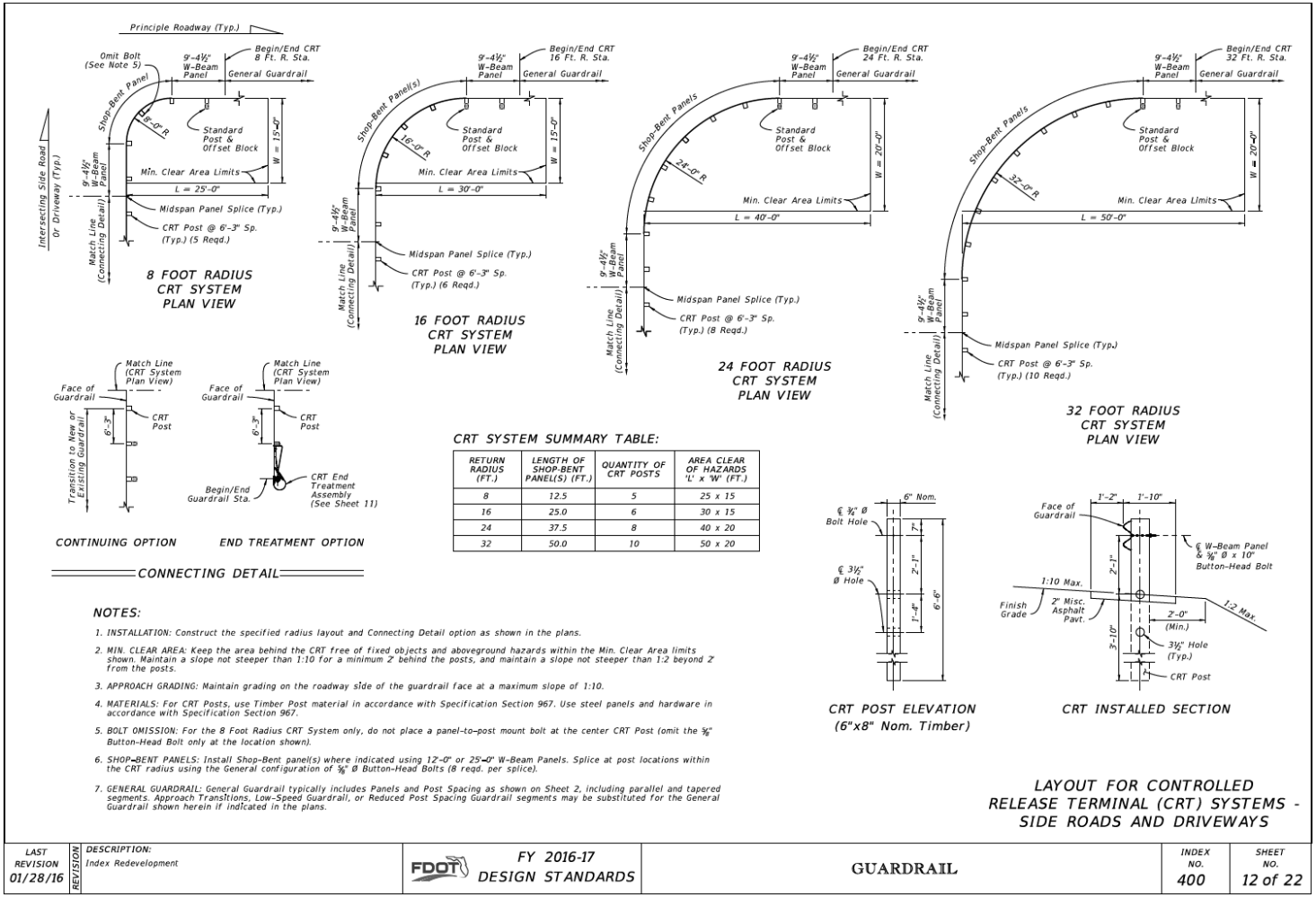
End Treatment - Controlled Release Terminal (CRT) System:



- For use with short radius guardrail systems as shown on the next sheet.
- This is the same as the previous Standard, only detailed more clearly.

Design Standards Index 400, Sheet 12

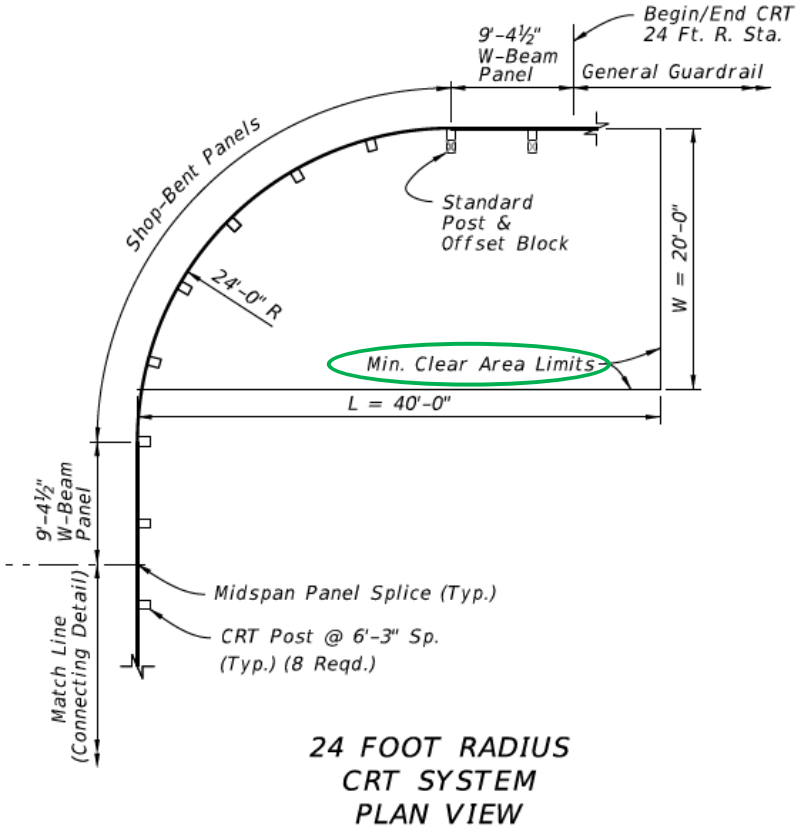
Layout for Controlled Release Terminal (CRT) System:



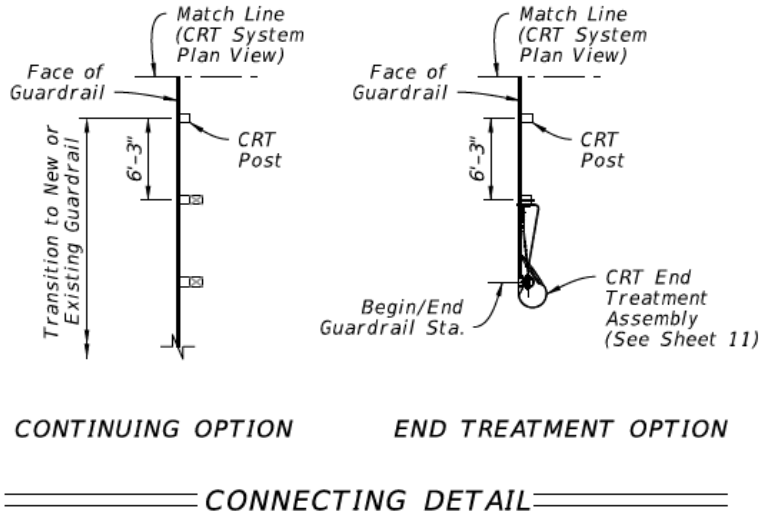
- Used for 90 degree intersection of principle roadway and side road or driveway
- This is nearly the same as the previous standard, only detailed more clearly
- Draw corresponding dimensions and radius in the Plans
- When terminating with a CRT End Treatment, the guardrail extends 15'-7½" from Match Line

Design Standards Index 400, Sheet 12

Layout for Controlled Release Terminal (CRT) System:



24 FOOT RADIUS CRT SYSTEM PLAN VIEW



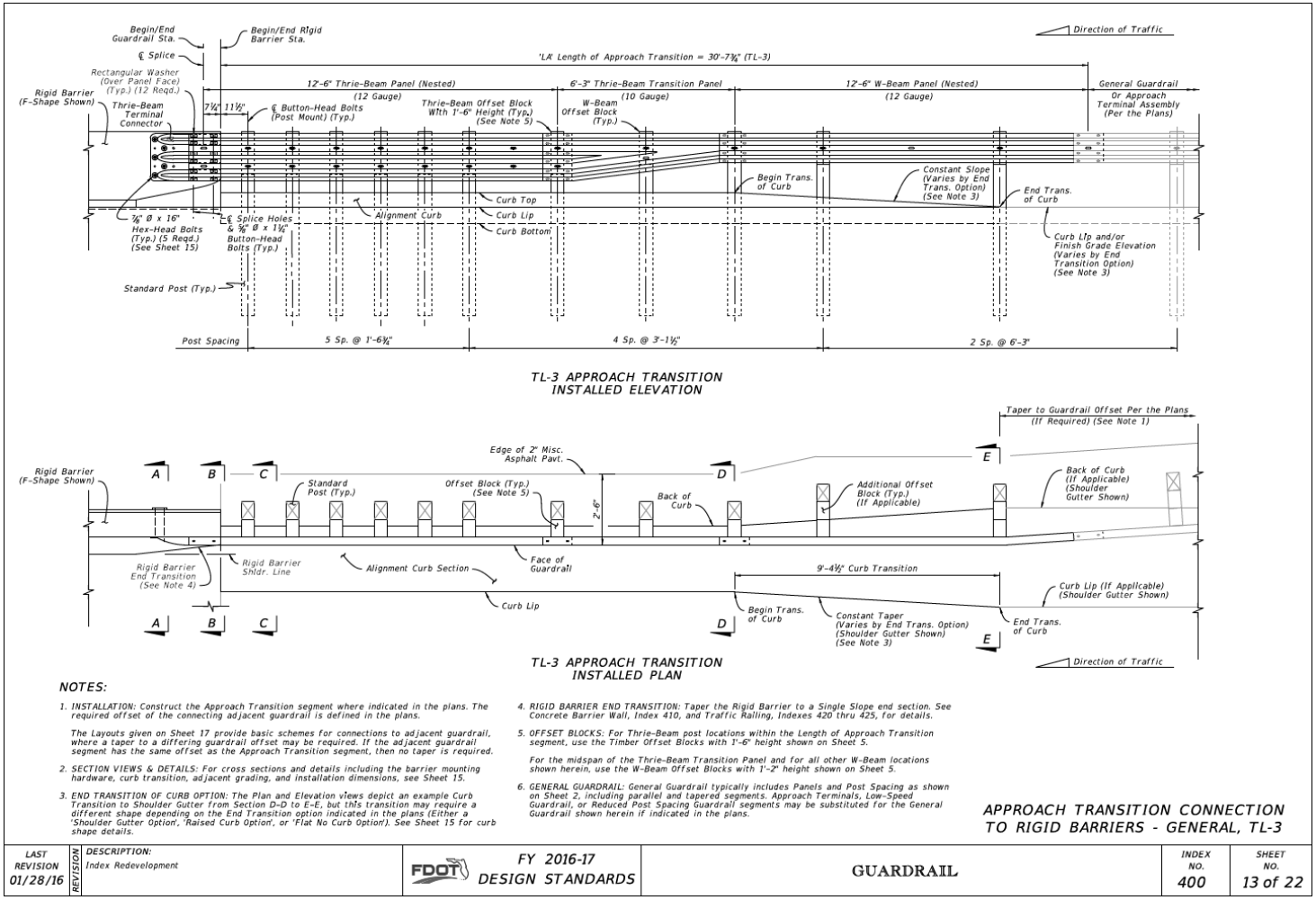
CONTINUING OPTION END TREATMENT OPTION

CONNECTING DETAIL

- *Min. Clear Area - Maintain 1:10 Slope to 2' behind the posts. Beyond that, maintain an area clear of hazards with a 1:2 or flatter slope.*

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:



NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is defined in the plans.

   The Layouts given on Sheet 17 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, curb transition, adjacent grading, and installation dimensions, see Sheet 15.

3. END TRANSITION OF CURB OPTION: The Plan and Elevation views depict an example Curb Transition to Shoulder Gutter from Section D-D to E-E, but this transition may require a different shape depending on the End Transition option indicated in the plans (Either a 'Shoulder Gutter Option', 'Raised Curb Option', or 'Flat No Curb Option'). See Sheet 15 for curb shape details.

4. RIGID BARRIER END TRANSITION: Taper the Rigid Barrier to a Single Slope end section. See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

5. OFFSET BLOCKS: For Thrie-Beam post locations within the Length of Approach Transition segment, use the Timber Offset Blocks with 1'-6" height shown on Sheet 5.

   For the midspan of the Thrie-Beam Transition Panel and for all other W-Beam locations shown herein, use the W-Beam Offset Blocks with 1'-2" height shown on Sheet 5.

6. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments. Approach Terminals, Low-Speed Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.

APPROACH TRANSITION CONNECTION TO RIGID BARRIERS - GENERAL, TL-3

LAST REVISION 01/28/16	REVISION	DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 13 of 22

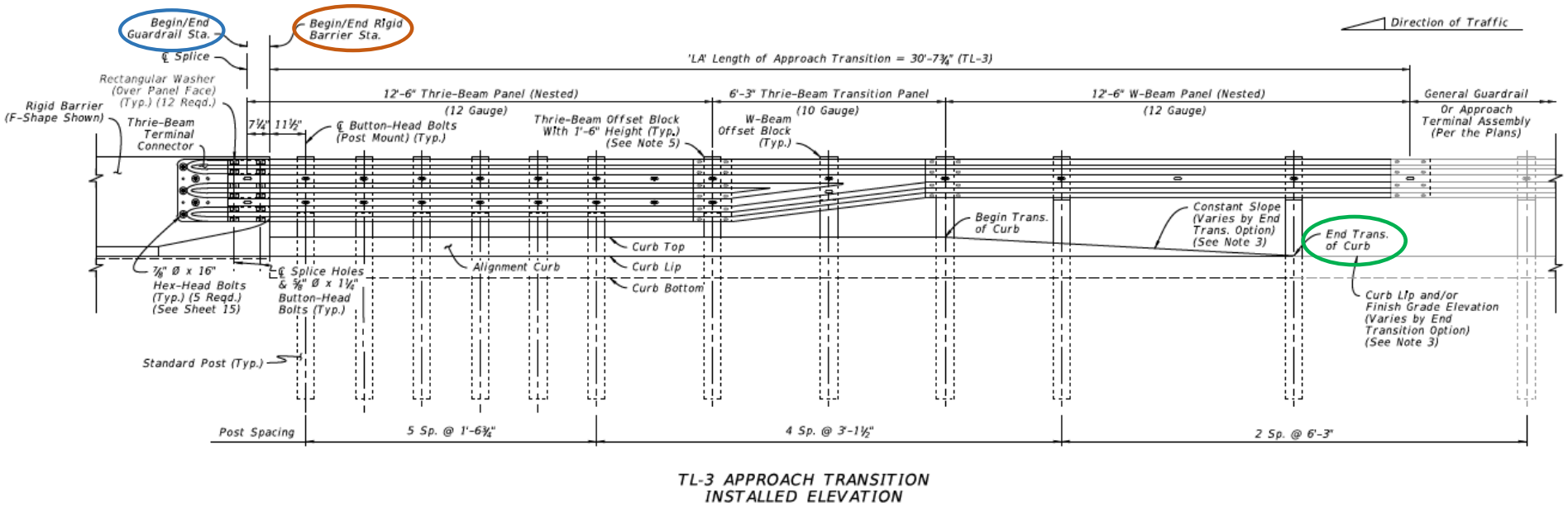
- ***ALL NEW!***
- MASH Tested
- Applicable to all Design Speeds
- About 12’-6” shorter than old “Detail J” from Rigid Barrier (about 25’ shorter including previous barrier overlap)
- New raised ‘Alignment Curb’ required
- Section Views on Sheet 15

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

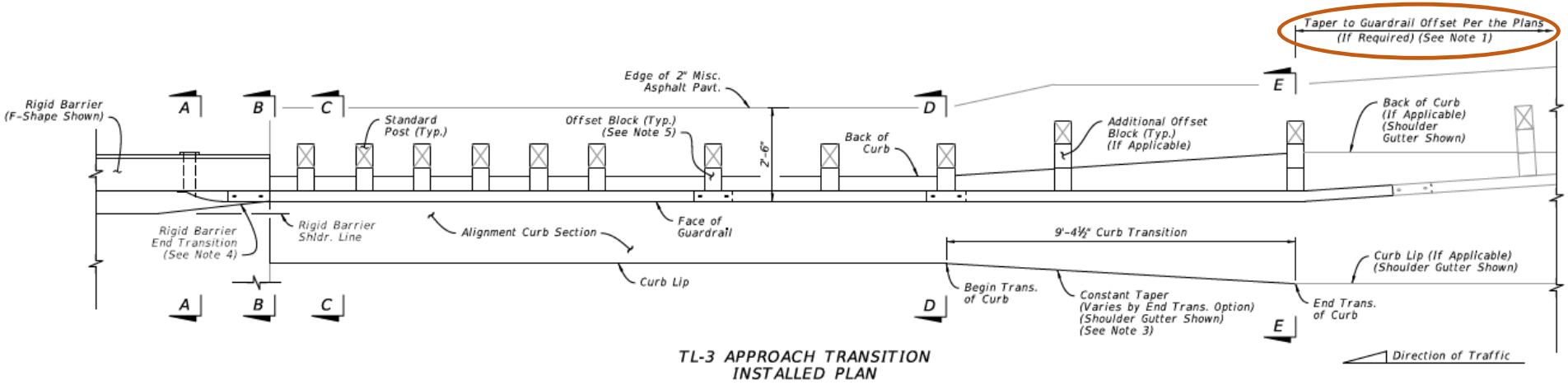


TL-3 APPROACH TRANSITION
INSTALLED ELEVATION

- **Begin/End Guardrail Station** called out – Corresponds to Roadway Plans callout – *Length of guardrail measured from here*
- **Begin/End *Rigid Barrier*** Station called out - *Different from Begin/End Guardrail Station* (governed by Thrie-Beam Terminal Connector with its Edge flush with Rigid Barrier) Guardrail's 7¼" overlap with the Rigid Barrier should be drawn this way in Plans
- **End Transition of Curb** – This is ***where typical curb type begins***, if here on project (e.g. Type F, Shoulder Gutter) **Starts 28'-1½"** from Begin/End Guardrail Station

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:



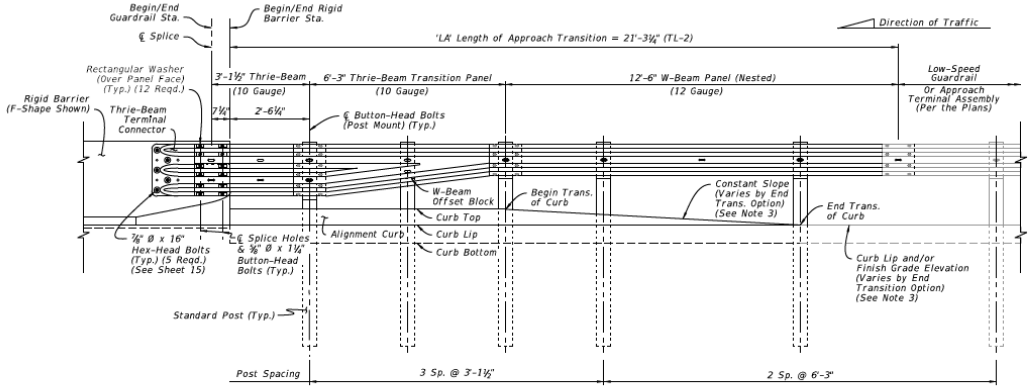
TL-3 APPROACH TRANSITION INSTALLED PLAN

- **Taper to Guardrail Offset per the Plans:** If roadway guardrail has a different lateral offset than the bridge railing guardrail, then your "Begin/End Taper" callout is given at Section E-E. (Starts 28'-1½" from Begin/End Guardrail Station)

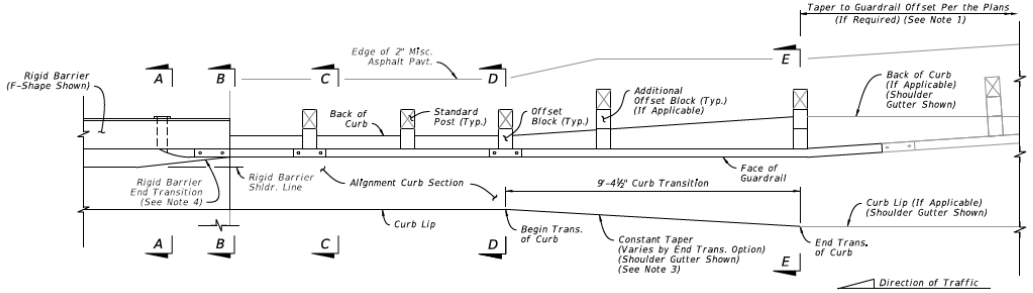
  *This leads to typical section, generally meeting PPM Fig 4.4.12

Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:



TL-2 APPROACH TRANSITION INSTALLED ELEVATION



TL-2 APPROACH TRANSITION INSTALLED PLAN

NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is defined in the plans.

   The Layouts given on Sheet 17 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, curb transition, adjacent grading, and installation dimensions, see Sheet 15.

3. END TRANSITION OF CURB OPTION: The Plan and Elevation views depict an example Curb Transition to Shoulder Gutter from Section D-D to E-E, but this transition may require a different shape depending on the End Transition option indicated in the plans (Either a 'Shoulder Gutter Option', 'Raised Curb Option', or 'Flat No Curb Option'). See Sheet 15 for curb shape details.

4. RIGID BARRIER END TRANSITION: Taper the Rigid Barrier to a Single Slope end section. See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

5. LOW-SPEED GUARDRAIL: Low-Speed Guardrail typically includes Panels and Post Spacing as shown on Sheet 3, including parallel and tapered segments. Approach Terminals, General Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the Low-Speed Guardrail shown herein if indicated in the plans.

APPROACH TRANSITION CONNECTION TO RIGID BARRIER - LOW-SPEED, TL-2

LAST REVISION	REVISION	DESCRIPTION:	FDOT			INDEX NO.	SHEET NO.
02/01/16		Index Redevelopment	FY 2017-18 DESIGN STANDARDS	GUARDRAIL		400	14 of 22

- ***ALL NEW!***
- MASH Tested
- Applicable to **Design Speeds ≤ 45 mph**
- Shorter and less robust design for cost savings
- New raised 'Alignment Curb' required
- Section Views on Sheet 15

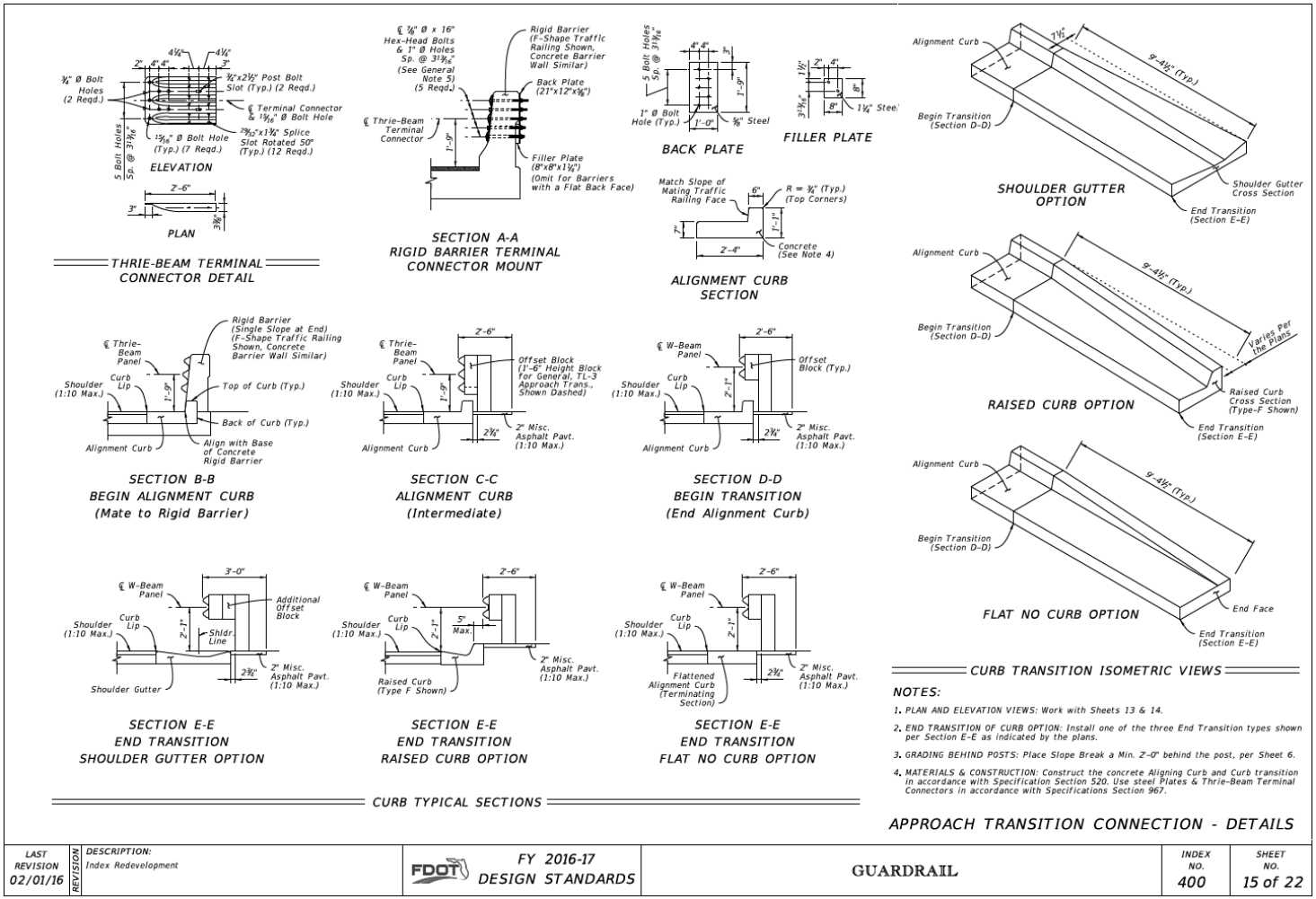
Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:

- ***ALL NEW!***
- MASH Tested
- Applicable to **Design Speeds ≤ 45 mph**
- Shorter and less robust design for cost savings
- New raised 'Alignment Curb' required
- Section Views on Sheet 15

Design Standards Index 400, Sheet 15

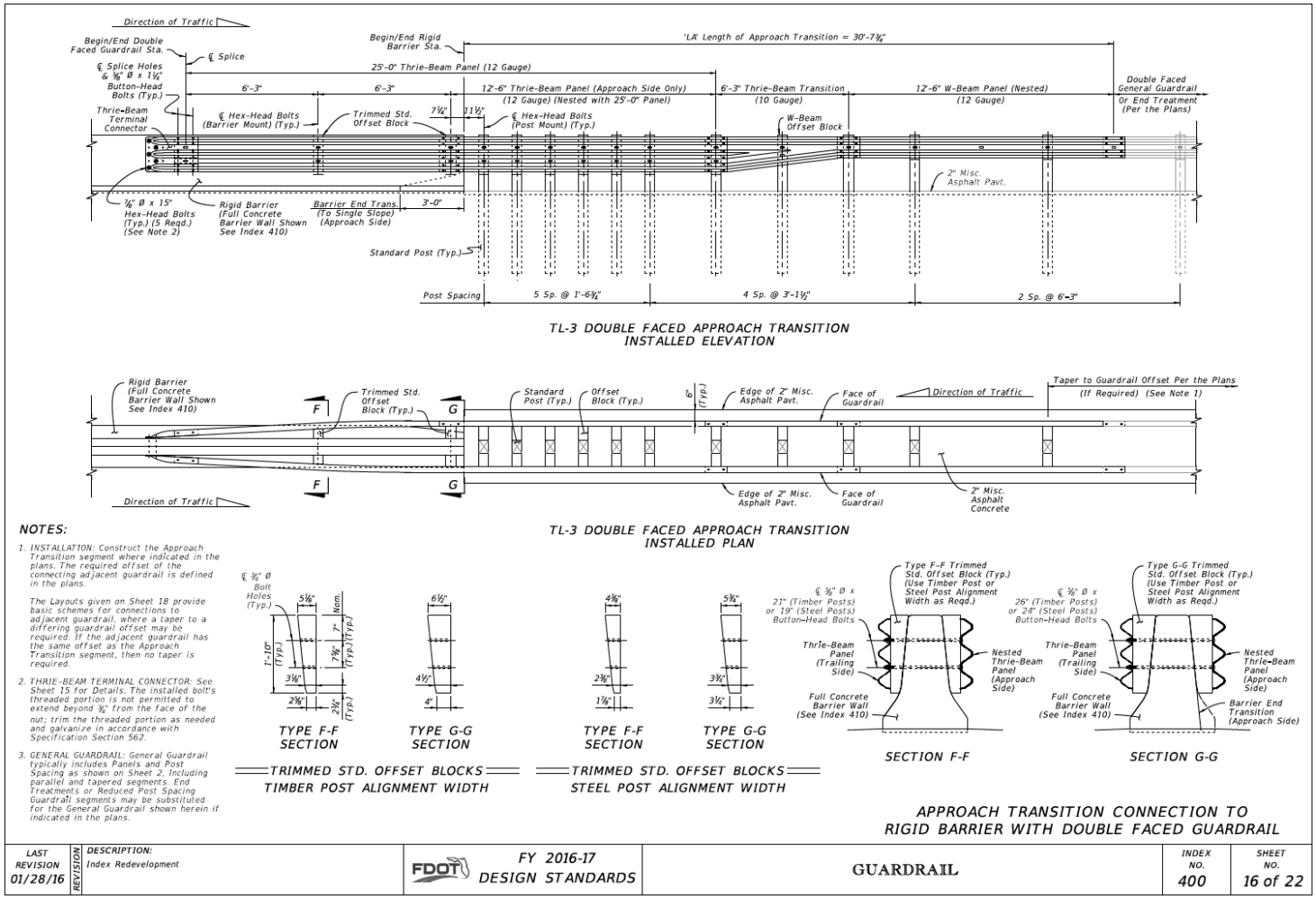
Approach Transition Connection Details:



- Shows Cross Section details for Approach Transitions on previous Sheets.
- Provides curb transitions for three types of curb Options
  1. *Shoulder Gutter*
  2. *Raised Curb*
  3. *No Curb*

Design Standards Index 400, Sheet 16

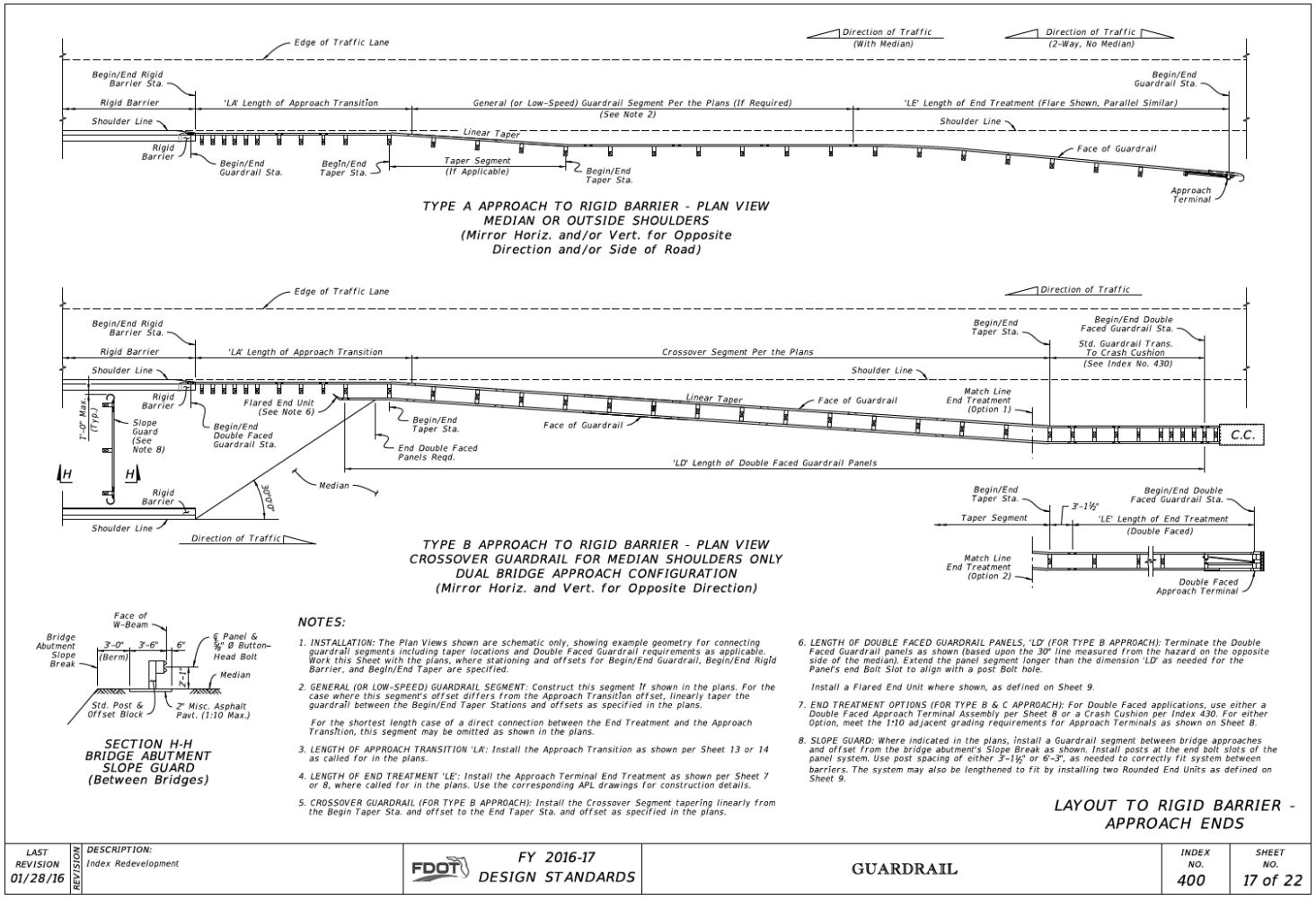
Approach Transition Connection to Rigid Barrier, Double Faced:



- ***ALL NEW!***
- Applies to all Design Speeds
- "Hybrid" of previous Double Faced Transition and MASH-Tested TL-3 Approach Transition
- Adds 12'-6" barrier overlap needed to transition guardrail to Rigid Barrier Width

Design Standards Index 400, Sheet 17

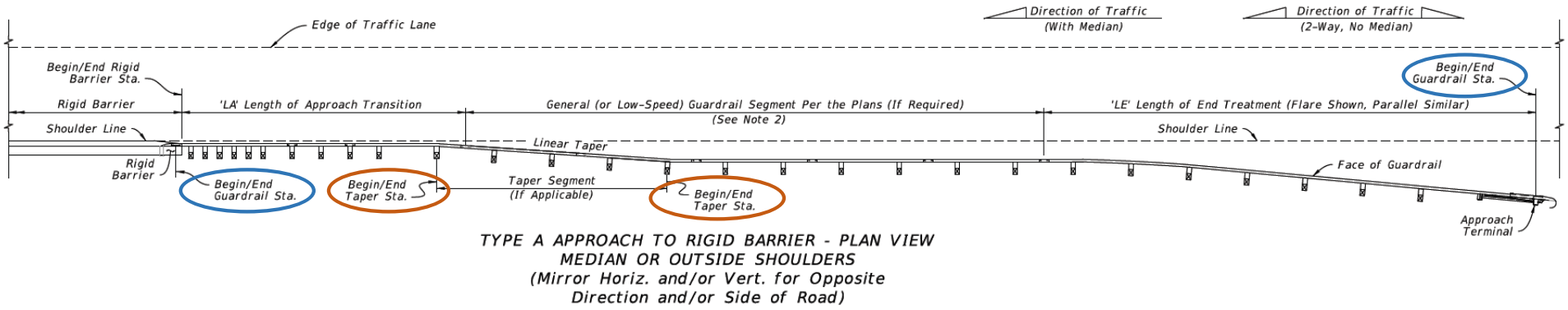
Layouts to Rigid Barrier, Single Barrier Approach or Median Crossover:



- Provides Example Layout "Types" that will correspond to callouts in the Plans
- Shows how segments in previous sheets connect together

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, Single Barrier Approach:



TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(Mirror Horiz. and/or Vert. for Opposite
Direction and/or Side of Road)

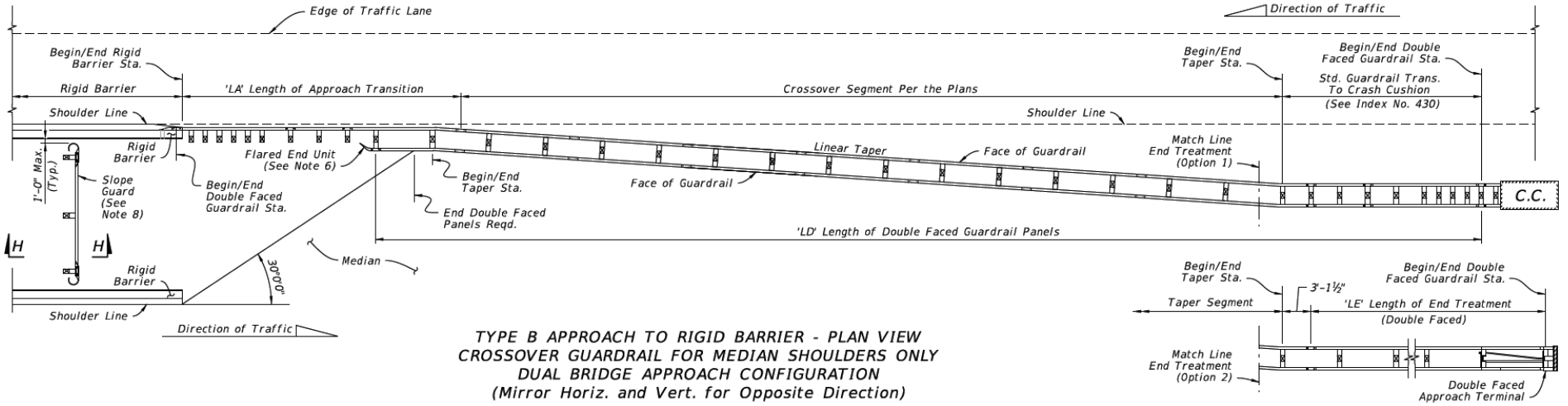
- Shows Approach Transition, General Guardrail, and Approach Terminal End Treatment as one system. NOTE: For shortest case of Rigid Barrier end protection, General Guardrail segment may be omitted (simply 'LA' + 'LE')

- **Begin/End Guardrail Stations** called out – Corresponds to Roadway Plans callout – Corresponds to callouts on preceding sheets – *Defines length of Guardrail*

- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callout –
  This is typically where the Guardrail begins tapering to its typical section on Sheet 6
  (guardrail face usually goes to paved shoulder line plus 2 feet, or it's measured from face of curb).
  *This starts at Section E-E on Sheets 13-15!
  Taper rate guidance is provided in the IDS.

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, "Median Crossover Guardrail":

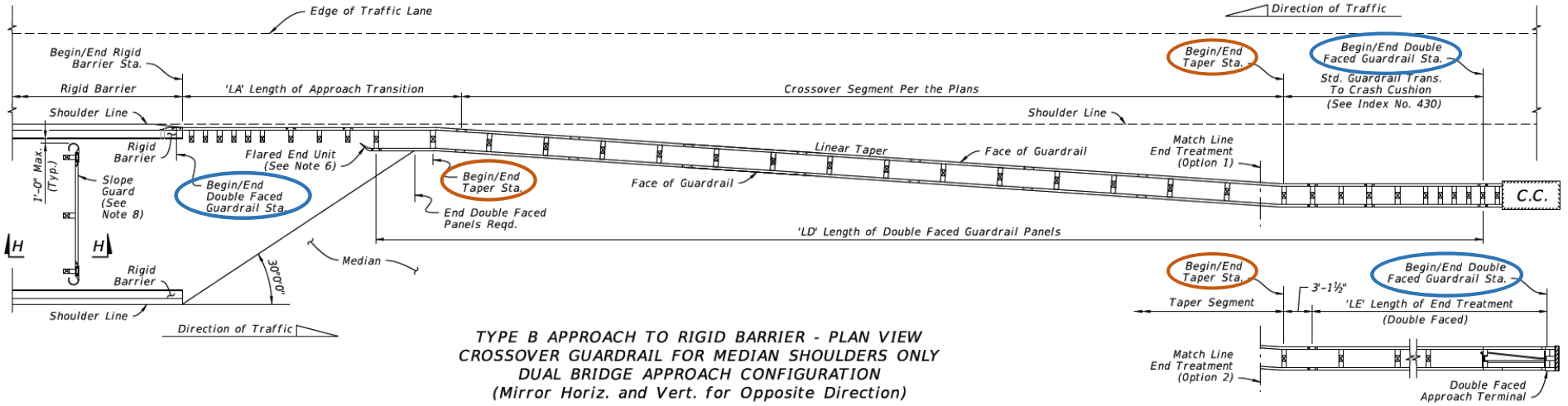


TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- Shows layout for shielding Rigid Barriers of dual bridges, where the concrete railing across the median is within the clear zone (this places the back of the shielding guardrail in the opposing lane's clear zone as well)
- *The "Median Guardrail Crossover" is most efficient design for the shortest Length of Need*

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, "Median Crossover Guardrail":



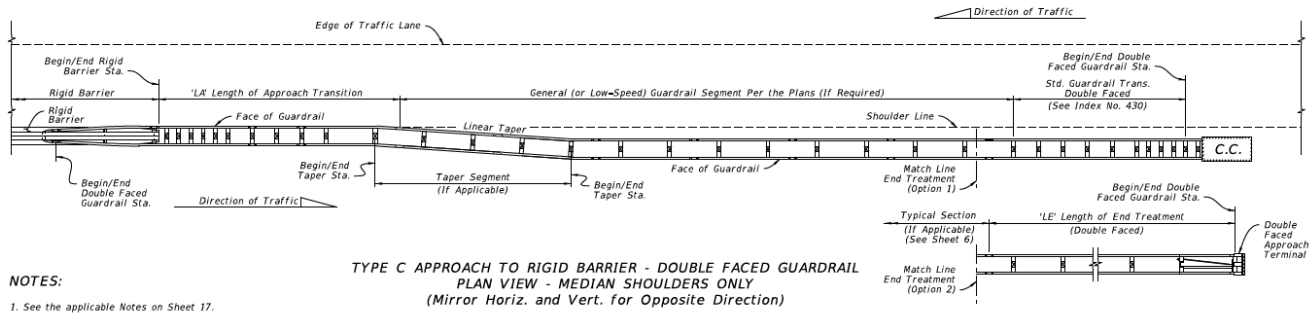
TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- **Begin/End Double Faced Guardrail Stations** called out – Corresponds to Roadway Plans
  NOTE: The *Double Faced Guardrail Pay Item* applies from the Rigid Barrier Connection to the End Treatment (even over the single faced Approach Transition Connection).

- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callout. The station and offset callouts define the linear taper rate for the contractor.
  NOTE: The ***'Guardrail Length of Need Program'*** assists with providing these stations and offsets.

Design Standards Index 400, Sheet 18

Layouts to Rigid Barrier, Double Faced Approach and Trailing End:

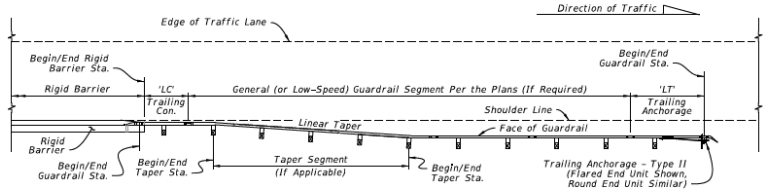


TYPE C APPROACH TO RIGID BARRIER - DOUBLE FACED GUARDRAIL
PLAN VIEW - MEDIAN SHOULDERS ONLY
(Mirror Horiz. and Vert. for Opposite Direction)

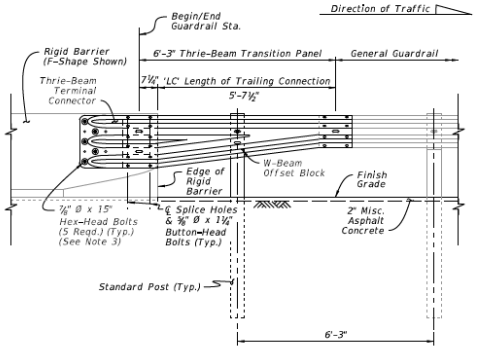
NOTES:

1. See the applicable Notes on Sheet 17.

LAYOUT TO RIGID BARRIER - APPROACH ENDS WITH DOUBLE FACED GUARDRAIL



TYPE D TRAILING CONNECTION FROM RIGID BARRIER
PLAN VIEW - MEDIAN OR OUTSIDE SHOULDER
(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)



TRAILING END TRANSITION CONNECTION
TO RIGID BARRIER - INSTALLED ELEVATION

NOTES:

1. See the applicable Notes on Sheet 17.
2. LENGTH OF TRAILING ANCHORAGE, 'LT': Install the Trailing Anchorage - Type II as shown on Sheet 9, where called for in the plans.
3. THRIE-BEAM TERMINAL CONNECTOR: Install connector and bolts as shown on Sheet 15.
4. RIGID BARRIER SINGLE SLOPE END FACE: See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

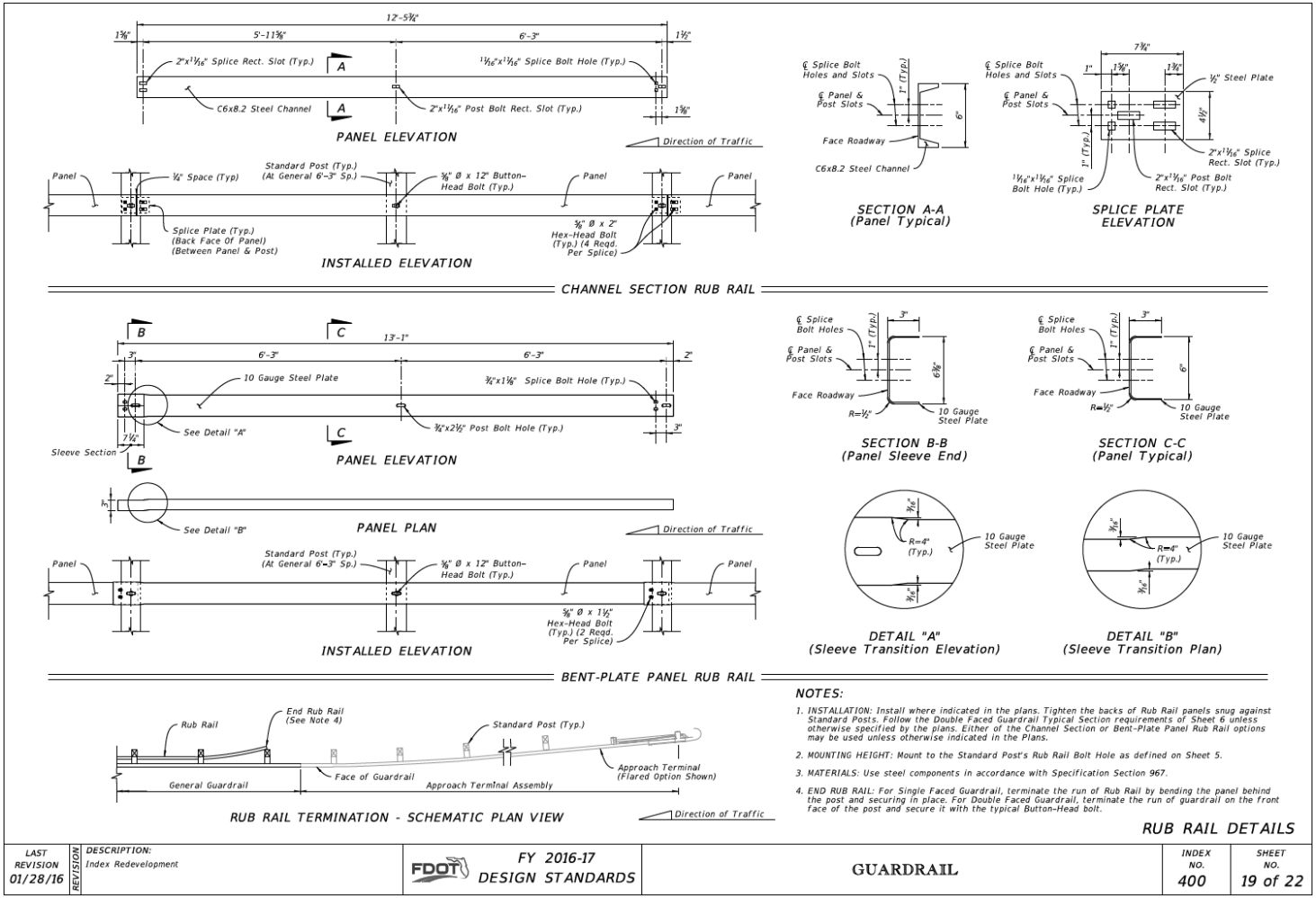
LAYOUT TO RIGID BARRIER - TRAILING ENDS

LAST REVISION 01/28/16	REVISION	DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 18 of 22

- More Example Layout "Types" that will correspond to callouts in the Plans
- Shows how segments in previous sheets connect together

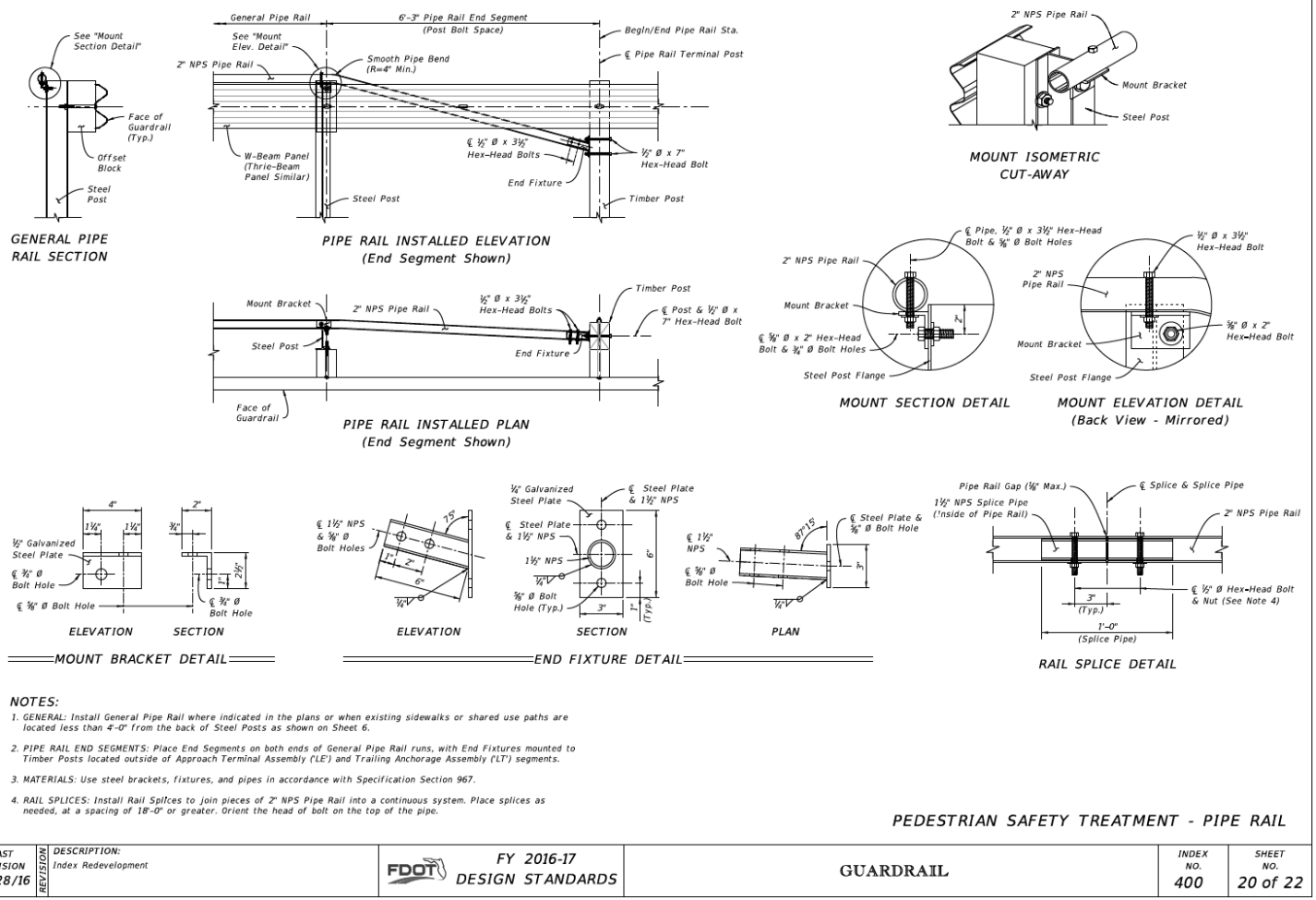
Design Standards Index 400, Sheet 19

Rub Rail Details:



- ***NEW!* Rub Rail Details** are now Provided for same old Rub Rail!
- Remember, from Sheet 6, use Rub Rail only for median slopes greater than 1:10 (with a 1:6 Max. slope in general)

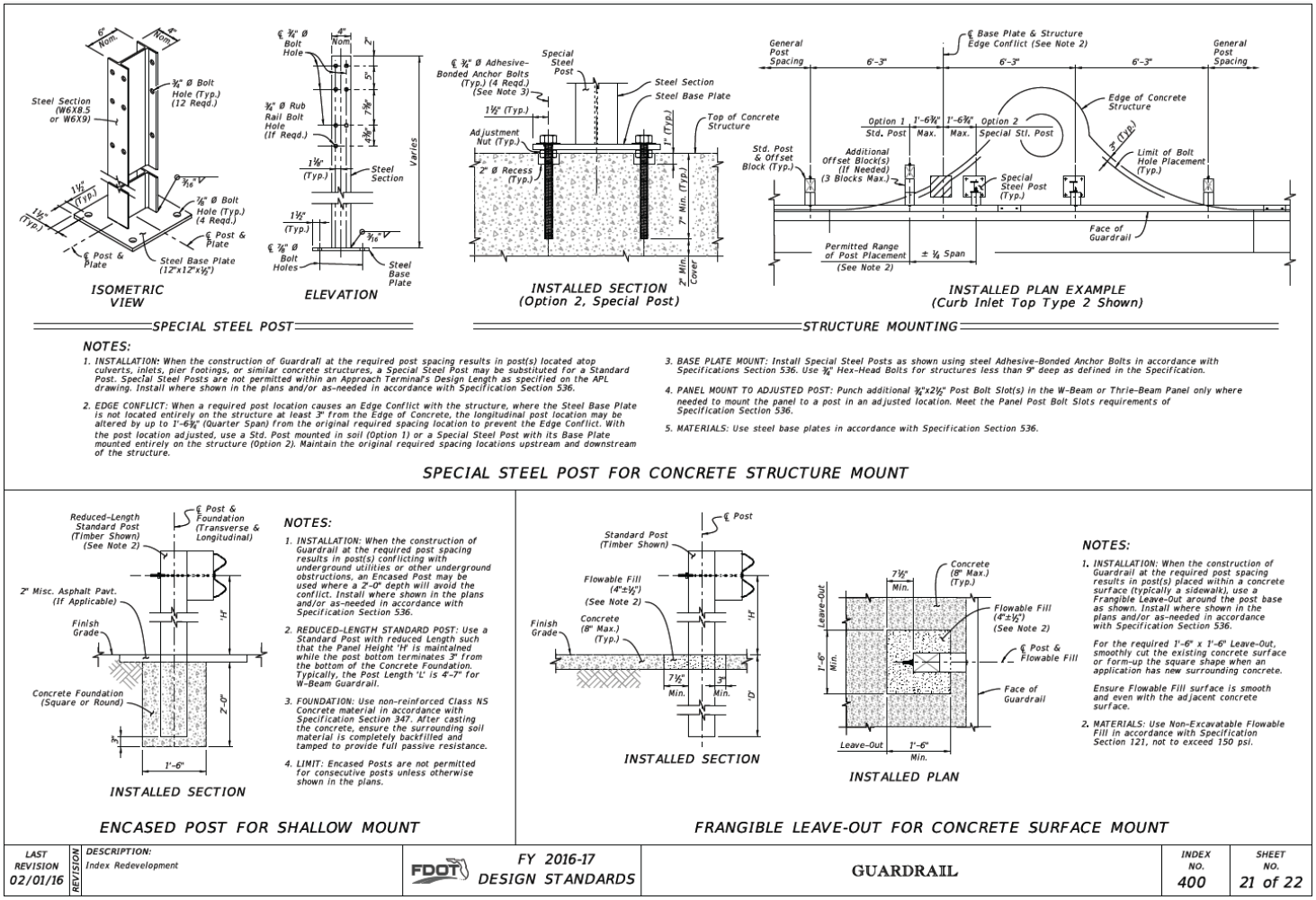
Pedestrian Safety Treatment – Pipe Rail:



- This is the same as the previous Standard, only detailed more clearly and with more construction issues addressed.
- Remember, use within 4 feet of a sidewalk or shared use path (assume Contractor will choose Steel Posts)

Design Standards Index 400, Sheet 21

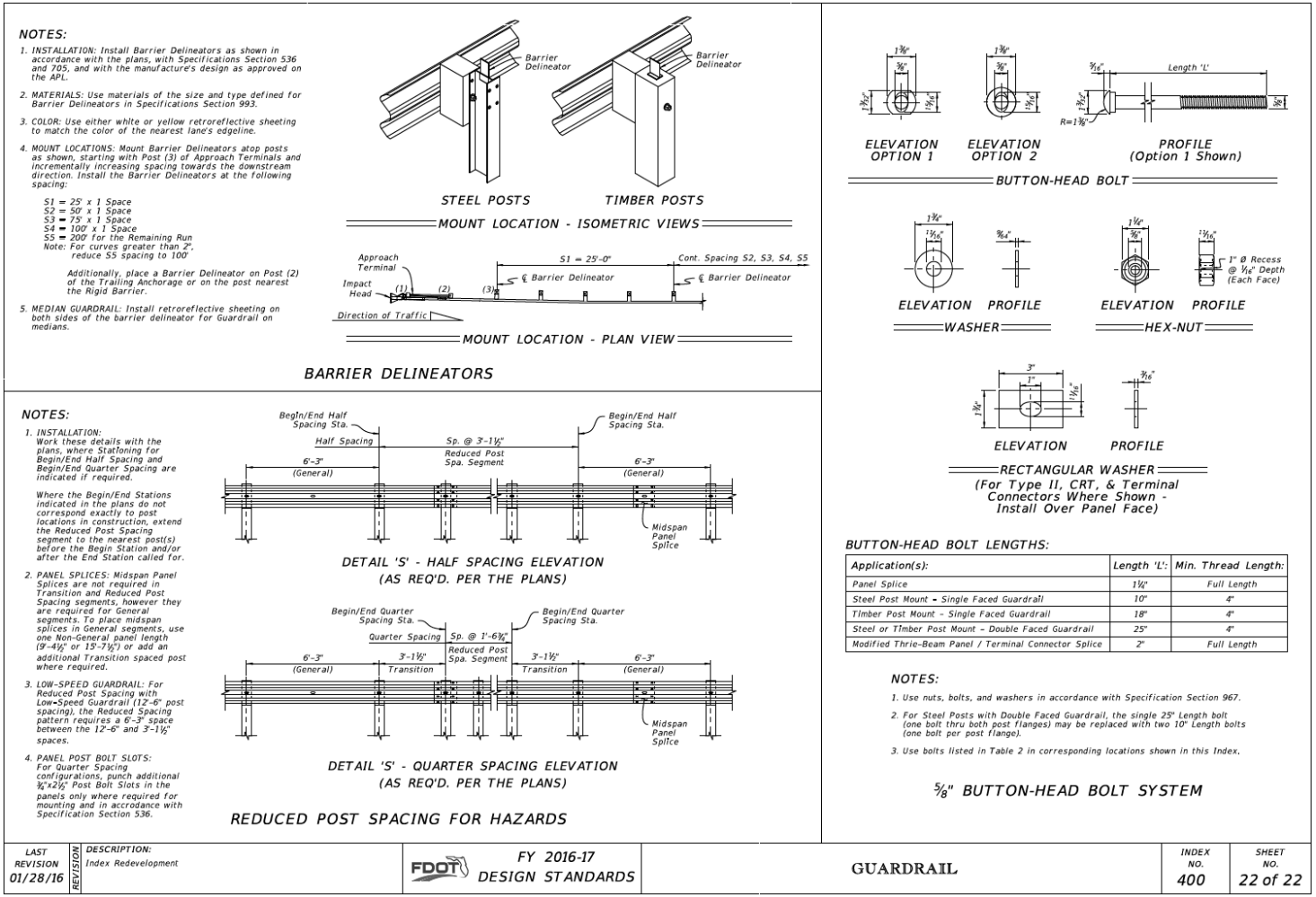
Special Steel Post, Encased Post, Frangible Leave Out:



- ***NEW AND IMPROVED!*** (mostly)
- **"Modified Mounts"** allow different post mounting options for the scenarios of:
  - **Posts atop a concrete structure**
  - **Posts over shallow underground utilities**
  - **Post atop concrete surface (sidewalk)**

Design Standards Index 400, Sheet 22

Barrier Delineators, Reduced Post Spacing, Bolt System:



NOTES:

1. INSTALLATION: Install Barrier Delineators as shown in accordance with the plans, with Specifications Section 536 and 705, and with the manufacture's design as approved on the APL.
2. MATERIALS: Use materials of the size and type defined for Barrier Delineators in Specifications Section 993.
3. COLOR: Use either white or yellow retroreflective sheeting to match the color of the nearest lane's edgeline.
4. MOUNT LOCATIONS: Mount Barrier Delineators atop posts as shown, starting with Post (3) of Approach Terminals and incrementally increasing spacing towards the downstream direction. Install the Barrier Delineators at the following spacing:

   S1 = 25' x 1 Space
   S2 = 50' x 1 Space
   S3 = 75' x 1 Space
   S4 = 100' x 1 Space
   S5 = 200' for the Remaining Run
   Note: For curves greater than 2°, reduce S5 spacing to 100'

   Additionally, place a Barrier Delineator on Post (2) of the Trailing Anchorage or on the post nearest the Rigid Barrier.
5. MEDIAN GUARDRAIL: Install retroreflective sheeting on both sides of the barrier delineator for Guardrail on medians.

Barrier Delineator

STEEL POSTS TIMBER POSTS

MOUNT LOCATION - ISOMETRIC VIEWS

Approach Terminal, Impact Head, S1 = 25'-0", Cont. Spacing S2, S3, S4, S5, ℄ Barrier Delineator, Direction of Traffic

MOUNT LOCATION - PLAN VIEW

BARRIER DELINEATORS

NOTES:

1. INSTALLATION: Work these details with the plans, where Stationing for Begin/End Half Spacing and Begin/End Quarter Spacing are indicated if required.

   Where the Begin/End Stations indicated in the plans do not correspond exactly to post locations in construction, extend the Reduced Post Spacing segment to the nearest post(s) before the Begin Station and/or after the End Station called for.
2. PANEL SPLICES: Midspan Panel Splices are not required in Transition and Reduced Post Spacing segments, however they are required for General segments. To place midspan splices in General segments, use one Non-General panel length (9'-4½" or 15'-7½") or add an additional Transition spaced post where required.
3. LOW-SPEED GUARDRAIL: For Reduced Post Spacing with Low-Speed Guardrail (12'-6" post spacing), the Reduced Spacing pattern requires a 6'-3" space between the 12'-6" and 3'-1½" spaces.
4. PANEL POST BOLT SLOTS: For Quarter Spacing configurations, punch additional ¾"x2½" Post Bolt Slots in the panels only where required for mounting and in accrodance with Specification Section 536.

Begin/End Half Spacing Sta., Half Spacing, Sp. @ 3'-1½" Reduced Post Spa. Segment, 6'-3" (General), Midspan Panel Splice

DETAIL 'S' - HALF SPACING ELEVATION (AS REQ'D. PER THE PLANS)

Begin/End Quarter Spacing Sta., Quarter Spacing, Sp. @ 1'-6¾", 6'-3" (General), 3'-1½" Transition, Reduced Post Spa. Segment

DETAIL 'S' - QUARTER SPACING ELEVATION (AS REQ'D. PER THE PLANS)

REDUCED POST SPACING FOR HAZARDS

ELEVATION OPTION 1, ELEVATION OPTION 2, PROFILE (Option 1 Shown), Length 'L'

BUTTON-HEAD BOLT

ELEVATION PROFILE WASHER

ELEVATION PROFILE HEX-NUT

1" Ø Recess @ ⅛" Depth (Each Face)

ELEVATION PROFILE

RECTANGULAR WASHER (For Type II, CRT, & Terminal Connectors Where Shown - Install Over Panel Face)

BUTTON-HEAD BOLT LENGTHS:

Application(s):	Length 'L':	Min. Thread Length:
Panel Splice	1¼"	Full Length
Steel Post Mount - Single Faced Guardrail	10"	4"
Timber Post Mount - Single Faced Guardrail	18"	4"
Steel or Timber Post Mount - Double Faced Guardrail	25"	4"
Modified Thrie-Beam Panel / Terminal Connector Splice	2"	Full Length

NOTES:

1. Use nuts, bolts, and washers in accordance with Specification Section 967.
2. For Steel Posts with Double Faced Guardrail, the single 25" Length bolt (one bolt thru both post flanges) may be replaced with two 10" Length bolts (one bolt per post flange).
3. Use bolts listed in Table 2 in corresponding locations shown in this Index.

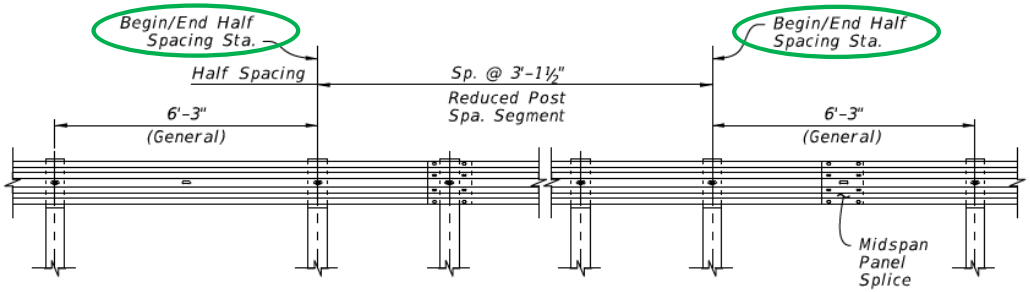
⅝" BUTTON-HEAD BOLT SYSTEM

LAST REVISION	REVISION	DESCRIPTION:	FDOT		INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FY 2016-17 DESIGN STANDARDS	GUARDRAIL	400	22 of 22

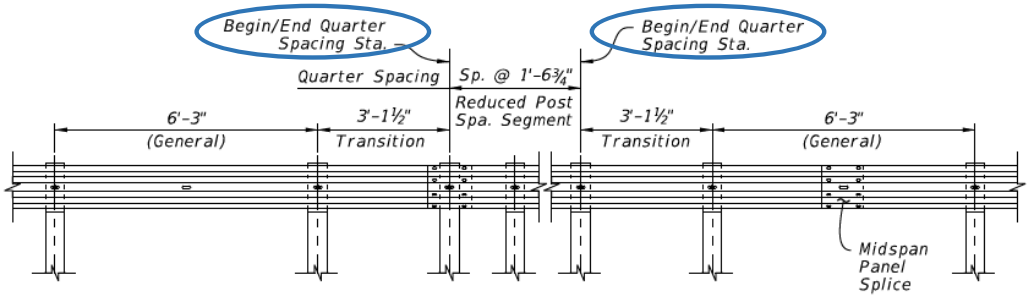
- ***LAST INDEX SHEET!***
- Includes Miscellaneous Details for the Contractor like Barrier Delineation and Standard Bolt Information
- The "Reduced Post Spacing for Hazards" detail simplifies post spacing transitions for designers

Design Standards Index 400, Sheet 22

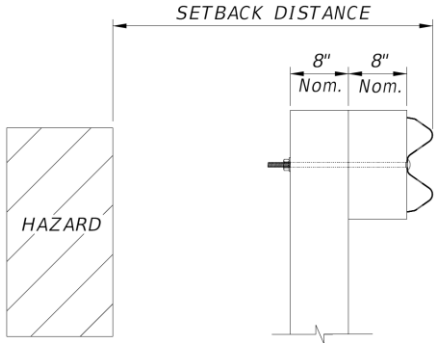
Reduced Post Spacing for Hazards (Reduced Setback Clearance) :



DETAIL 'S' - HALF SPACING ELEVATION
(AS REQ'D. PER THE PLANS)



DETAIL 'S' - QUARTER SPACING ELEVATION
(AS REQ'D. PER THE PLANS)



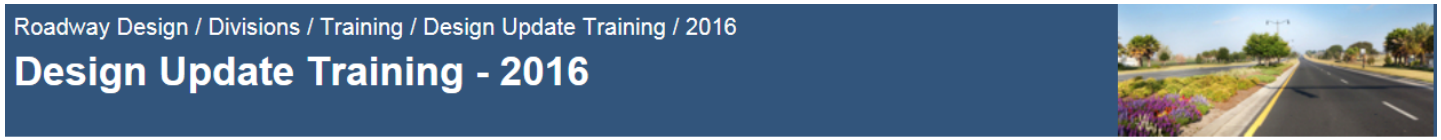
From PPM: Table 4.4.2 Minimum Barrier Setback:

Semi-Rigid Barrier	
W-Beam with Post Spacing @ 6'-3" (TL-3)	5'-0"
W-Beam with Post Spacing @ 3'-1½" (½ Spacing)	3'-10"
W-Beam with Post Spacing @ 1'-6¾" (¼ Spacing)	3'-2"
Nested W-Beams with Post Spacing @ 3'-1½" (½ Spacing)	3'-0"
Nested W-Beams with Post Spacing @ 1'-6¾" (¼ Spacing)	2'-8"
Modified Thrie-Beam with Post Spacing @ 6'-3"	3'-0"

- When an aboveground hazard is within 5'-0" behind the face of guardrail, *reduced post spacing* may be used to reduce the "Setback" requirement to the hazard (see PPM Table below)
- The designer must call out the reduced post spacing as required per the table, and the Design Standard will handle the transition of post spacing before and after
- The Standard extends the reduced post spacing to the nearest post outside of the station range called for.
- The Standard also handles Low-speed Guardrail 12'-6" spacing, explaining that the spacing sequence remains the same, but with the 12'-6" adjacent to the 6'-3" spacing.

Where to Find More Comprehensive Training:

- ***This month, a 6 hour design webinar will be placed here…***
  http://www.dot.state.fl.us/rddesign/Training/Webinar16/Pres16.shtm



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February 2016

Description	PDF	Video	Presenter/Contact

Design Standards Index 400 - Guardrail

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THANK YOU!

QUESTIONS?

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